



Faculty of Economics and Business

How do Vertical Fiscal Imbalances Impact China's Economic Development Quality? The Dual Effect of Local Government's Tax Effort and Expenditure Structure Through Simultaneous Equations

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How do Vertical Fiscal Imbalances Impact China's Economic Development
Quality? The Dual Effect of Local Government's Tax Effort and Expenditure
Structure Through Simultaneous Equations

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

China's economy has shifted from rapid growth to high-quality development, making the improvement of economic development quality and sustainability a pressing issue for the government. The existing literature primarily focuses on the impact of vertical fiscal imbalance on the scale of economic growth, yet there is no consensus on the direct mechanisms through which it affects the quality of economic development. Moreover, there has only been limited research on the dual mediating pathways through which VFI influences economic development quality via tax effort and expenditure structure. This study uses panel data from 30 provinces in China from 2008 to 2022 and applies the Three-Stage Least Squares method to analyse how vertical fiscal imbalance, local government tax effort, and expenditure structure impact the quality of economic development at the national level and in the eastern, central, and western regions.

The results indicate that increasing vertical fiscal imbalance not only directly hinders the quality of economic development but also indirectly affects it by reducing local governments' tax efforts and improving the proportion of livelihood-related public expenditure. After standardizing the panel data, the study further quantifies the direct and indirect effects within these mechanisms. The direct effect in the tax effort model is larger than the indirect effect, while in the expenditure structure model, the direct effect is smaller than the indirect effect. Overall, the current level of vertical fiscal imbalance will help improve economic development quality in China.

Additionally, regional regressions reveal that in the eastern region, as is the case nationally, the vertical fiscal imbalance directly negatively impacts the quality of economic

development, while the indirect effect is positive, resulting in a negative overall effect. In the central region, the direct effect is negative, but since vertical fiscal imbalance does not significantly impact expenditure structure, there is no indirect effect through this pathway. However, the indirect effect through tax effort is positive, again leading to a negative overall effect. In the western region, conversely, the direct effect is positive, and with no indirect effect, the overall effect is also positive. In the eastern region, where fiscal revenues are relatively abundant, governments tend to optimize resource allocation by adjusting expenditure structures. In contrast, local governments in the central and western regions face greater fiscal pressures and are more reliant on central fiscal transfers, which limits their capacity to adjust tax effort and expenditure structures.

Therefore, it is necessary to control vertical fiscal imbalance, tailor the policy on it to local conditions, and optimize political performance incentives to establish a clear fiscal relationship between central and local governments. This will help balance fiscal power across regions, enhance the quality of economic development, and achieve sustainable development for both local and national economies.

Keywords: Vertical Fiscal Imbalance, Tax Effort, Expenditure Structure, Quality of Economic Development

***Bagaimanakah Ketidakseimbangan Fiskal Menegak Mempengaruhi Kualiti
Pembangunan Ekonomi China? Kesan Dua Serentak Usaha Cukai dan Struktur
Perbelanjaan Kerajaan Tempatan Melalui Persamaan Serentak***

ABSTRAK

Ekonomi negara Cina telah beralih dari fasa pertumbuhan pesat ke fasa pembangunan berkualiti tinggi. Meningkatkan kualiti pembangunan ekonomi dan mencapai pembangunan mampan telah menjadi isu penting yang perlu diselesaikan oleh kerajaan Cina. Kebanyakan kesusasteraan sedia ada menumpukan perhatian kepada kesan ketidakseimbangan fiskal menegak terhadap skala pertumbuhan ekonomi, namun masih tiada persetujuan mengenai mekanisme langsung yang menghubungkannya dengan kualiti pembangunan ekonomi. Selain itu, penyelidikan mengenai laluan pengantaraan berganda — di mana VFI mempengaruhi kualiti pembangunan ekonomi melalui usaha cukai dan struktur perbelanjaan — masih sangat terhad. Kajian ini menggunakan data panel dari 30 wilayah di negara Cina dari tahun 2008 hingga 2022, dan menggunakan kaedah Kuasa Dua Terkecil Tiga Peringkat untuk mengkaji mekanisme dan laluan bagaimana ketidakseimbangan fiskal menegak, usaha cukai kerajaan tempatan, dan struktur perbelanjaan mempengaruhi kualiti pembangunan ekonomi di peringkat kebangsaan serta di wilayah timur, tengah, dan barat.

Hasil kajian menunjukkan bahawa peningkatan ketidakseimbangan fiskal menegak bukan sahaja mengurangkan kualiti pembangunan ekonomi dengan ketaranya tetapi juga secara tidak langsung mempengaruhinya dengan menghalang peningkatan usaha cukai kerajaan tempatan dan mengurangkan bahagian perbelanjaan awam yang berkaitan dengan kebajikan rakyat. Melalui penyeragaman data panel, kajian ini juga mengukur saiz kesan langsung dan tidak langsung dalam mekanisme tersebut. Kesan langsung dalam model

usaha cukai kerajaan tempatan adalah lebih kecil daripada kesan tidak langsung, manakala dalam model struktur perbelanjaan kerajaan tempatan, kesan langsung adalah lebih besar daripada kesan tidak langsung. Secara keseluruhannya, tahap ketidakseimbangan fiskal menegak di negara Cina pada masa ini menggalakkan peningkatan kualiti pembangunan ekonomi.

Selain daripada itu, analisis regresi di wilayah timur, tengah, dan barat menunjukkan bahawa di wilayah timur, hasilnya serupa dengan peringkat kebangsaan di mana kesan langsung ketidakseimbangan fiskal menegak terhadap kualiti pembangunan ekonomi adalah negatif, manakala kesan tidak langsung adalah positif, yang seterusnya menghasilkan kesan negatif secara keseluruhan. Di wilayah tengah, kesan langsung adalah negatif, tetapi kerana ketidakseimbangan fiskal menegak tidak mempunyai kesan yang ketara terhadap struktur perbelanjaan kerajaan tempatan, manakala tiada bukti kesan tidak langsung melalui laluan ini. Namun, kesan tidak langsung melalui usaha cukai adalah positif, dan ianya menyebabkan kesan keseluruhan yang negatif. Di wilayah timur, di mana hasil fiskal agak banyak, kerajaan cenderung untuk mengoptimalkan peruntukan sumber dengan penyelarasan struktur perbelanjaan. Sebaliknya, kerajaan tempatan di wilayah tengah dan barat menghadapi tekanan fiskal yang lebih besar dan lebih bergantung kepada pemindahan fiskal pusat, yang mengehadkan kemampuan mereka untuk menyesuaikan usaha cukai dan struktur perbelanjaan.

Oleh itu, adalah perlu untuk mengawal ketidakseimbangan fiskal menegak, menyesuaikan dasar mengenainya dengan keadaan tempatan, dan mengoptimalkan insentif prestasi politik untuk mewujudkan hubungan fiskal yang jelas antara kerajaan pusat dan tempatan. Ini akan membantu dalam penyelarasan kuasa fiskal dengan keseimbangan wilayah,

meningkatkan kualiti pembangunan ekonomi negara Cina, dan mencapai pembangunan mampan untuk ekonomi tempatan dan kebangsaan.

Kata kunci: *Ketidakseimbangan Fiskal Menegak, Usaha Cukai, Struktur Perbelanjaan, Kualiti Pembangunan Ekonomi*

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LIST OF ABBREVIATIONS

VFI	Vertical Fiscal Imbalance
Teffort	Tax Effort
Gstructure	Local Government Expenditure Structure
Quality	Quality of Economic Development
Open	Open to the Outside World
Ind	Industrial Structure
Pgdp	Per capita Gross Domestic Product
Gscale	Scale of Local Government Expenditure
Density	Population Density
Compete	Local Government Competition
Transfer	Transfer Payment Structure
Urban	Urbanization Rate
Ptax	Per capita Tax
Fss	Financial Self-sufficiency
Capital	Material Capital
D	Dummy Variable for Covid-19

CHAPTER 1

INTRODUCTION

1.1 Introduction

Since the implementation of reform and opening-up policies, China has successfully seized strategic opportunities emerging from the processes of urbanization and industrialization, achieving over 40 years of rapid growth and creating the China economic miracle. In recent years, China's economy has transitioned from rapid growth to a more moderate pace due to the global economic downturn and the impact of the Covid-19 pandemic, resulting in heightened downward pressure on the economy. Fiscal revenue growth has slowed, while fiscal expenditures have shown rigid growth, leading to an expanding fiscal deficit (Gao et al., 2019). Additionally, local governments require increasing fiscal expenditures to address environmental restoration, governance, and population aging, resulting in acute fiscal imbalances in some regions, with a few less economically developed areas even experiencing negative fiscal revenue growth (Wang et al., 2020). Although the central government maintains a surplus, with revenues exceeding expenditures, local governments face a mismatch between their fiscal responsibilities and revenues. The delegation of expenditure obligations is not always matched by corresponding tax revenue transfers, leading to a vertical fiscal imbalance (VFI) (Eyraud & Lusinyan, 2013).

Faced with the pressure of fiscal imbalances, how to transform fiscal pressure into development momentum to promote economic development quality has become a critical

concern for society. In line with China's fiscal decentralization system, local governments can objectively mitigate fiscal pressure by creating a favourable policy environment for the full release of market vitality through subsidies, tax reductions, and other measures. In the short term, tax reductions and subsidies may indeed lead to a decline in fiscal revenue, exacerbating fiscal imbalances. However, from a medium- to long-term perspective, tax reductions and subsidies can effectively stimulate market vitality, promote investment and consumption growth, and help expand the tax base, thereby contributing to a rebound in fiscal revenue. Furthermore, to mitigate the risk of fiscal imbalances caused by the short-term decline in revenue, local governments typically implement a series of complementary measures, such as optimizing expenditure structures (Liu et al., 2023), improving the efficiency of fiscal fund utilization, strengthening tax collection and administration, and promoting industrial upgrading (Zhu & Liu, 2020; Tian & Wang, 2023).

In addition, local government leaders are motivated by the political incentive of upward mobility. Local governments at the same administrative level engage in horizontal economic competition, and local leaders possess a considerable degree of autonomy in making decisions regarding economic and administrative matters (Jin, 2018). Chinese local governments tend to exhibit a short-termist tendency driven by promotion incentives. Due to the relatively short assessment cycles for officials, local governments often prioritize measures such as expanding investment, stimulating real estate, and accelerating infrastructure construction to rapidly boost GDP growth and achieve political performance gains. However, this approach may lead to resource misallocation, environmental pollution,

and rising debt risks, thereby undermining long-term sustainable development (Wang, 2016; Tong & Wang, 2018).

Therefore, local leaders are incentivized to allocate increased fiscal revenues for the provision of economic public goods that enhance the competitive advantage of their jurisdiction's GDP, thereby generating significant short-term economic growth performance. Under the dual influence of this objective foundation and internal mechanism, China's economy achieved rapid growth for a considerable period.

However, as China enters a new stage of economic development, the inconsistency between the pace of economic growth and the quality of economic development has become increasingly evident, with more issues detrimental to economic development quality emerging. From 2010 to 2019, China's GDP grew at an average annual rate of approximately 7.7%, while energy consumption per unit of GDP decreased by only 2.8% over the same period, indicating that green development was lagging behind economic growth (Zhao et al., 2021). Furthermore, in some regions, pollutant emissions increased rather than decreased despite the rapid economic expansion, suggesting that these regions prioritized short-term economic growth at the expense of long-term sustainability indicators, resulting in a mismatch between growth and quality (Liu et al., 2024).

The traditional extensive development model is no longer suitable for economic demands, and there is a growing need to improve national soft power and social happiness

indices as social, economic, and cultural development become increasingly uncoordinated (Ren, 2022).

The 19th National Congress of the Communist Party of China highlighted the transition of China's economy from rapid growth to a phase of high-quality development, with increasing popular demand for quality, making the resolution of livelihood issues urgent. During the Central Economic Work Conference in December 2017, the central government identified the promotion of high-quality development as a key criterion for shaping development strategies, crafting economic policies, and executing macroeconomic regulation both presently and in the future. The Central Economic Work Conference in December 2019 reiterated the need to balance reasonable economic growth with consistent quality improvements, emphasizing the focus on high-quality development. In October 2022, General Secretary Xi Jinping, in his report to the 20th National Congress of the Communist Party of China, underscored the urgency of accelerating the construction of a new development pattern centred on high-quality development, identifying this as the foremost task in building a modern socialist country.

In this context, how can we understand the fundamental connotations of high-quality development and what key issues need to be addressed? How will the increasing fiscal pressure on local governments impact the quality of economic development? In practice, many issues in the livelihood domain remain relatively severe, contrasting with the swift expansion of the economy. Progress in public services related to the quality of life remains relatively slow (Zhou, 2007; Wei et al., 2021). During fiscal management, governments at

all levels still tend to focus on the economic domain to meet GDP growth targets set by the central government, while paying less attention to social security, public health, education, and other livelihood areas. Addressing these issues is of significant practical importance to enhance people's sense of happiness and fulfilment and achieve sustainable economic development in the future.

At this critical juncture of economic transformation, the importance of fiscal policy as a key macroeconomic policy tool for promoting economic development quality cannot be overstated. Therefore, this study, based on existing research, explores the relationship between VFI and economic development quality, conducting an empirical analysis using provincial panel data. From the perspectives of local government tax effort and expenditure structure, the study further reveals the impact of VFI on economic development quality and the mechanisms behind this effect. The aim is to provide a reasonable explanation of the above issues from both theoretical and empirical perspectives, thereby providing a better comprehension of the role and limitations of VFI in the context of economic development quality.

1.2 Background Study

1.2.1 Definition of Terms

The concept of vertical fiscal imbalance (VFI) was first introduced by Wagner in 1973 and later formalized by Hettich and Winer (1986). They argued that VFI occurs when a country's central government has excess revenue, while state governments face significant

funding demands. Hunter (1977) explained VFI by examining the revenue distribution between central and local governments, proposing that an economy experiences VFI when the central government's revenue surpasses that of local governments. Li and Zhang (2019) proposed that vertical fiscal imbalance arises when expenditure responsibilities are not adjusted in line with intergovernmental revenue distribution. In China, vertical fiscal imbalance is characterized by the central government's limited responsibilities, with excessive interference in local matters through transfer payments. Cai and Chen (2023) argued that the centralization of fiscal authority combined with the delegation of expenditure responsibilities creates a natural misalignment among regional governments' revenues and spendings, leading to an inherent fiscal shortfall and VFI.

Figure 1.1 illustrates the vertical fiscal imbalance across 30 Chinese provinces from 2008 to 2022, revealing two key characteristics. First, despite differences among provinces, the vertical fiscal imbalance indices exhibit similar fluctuation patterns over the years. This indicates a certain degree of commonality in vertical fiscal imbalance nationwide. Second, provinces in the eastern coastal region (such as Jiangsu, Zhejiang, and Guangdong) display relatively lower indices, suggesting a milder degree of fiscal imbalance. In contrast, provinces in the central and western regions (such as Gansu, Qinghai, and Ningxia) show higher indices, indicating more pronounced fiscal mismatches between revenue and expenditure.

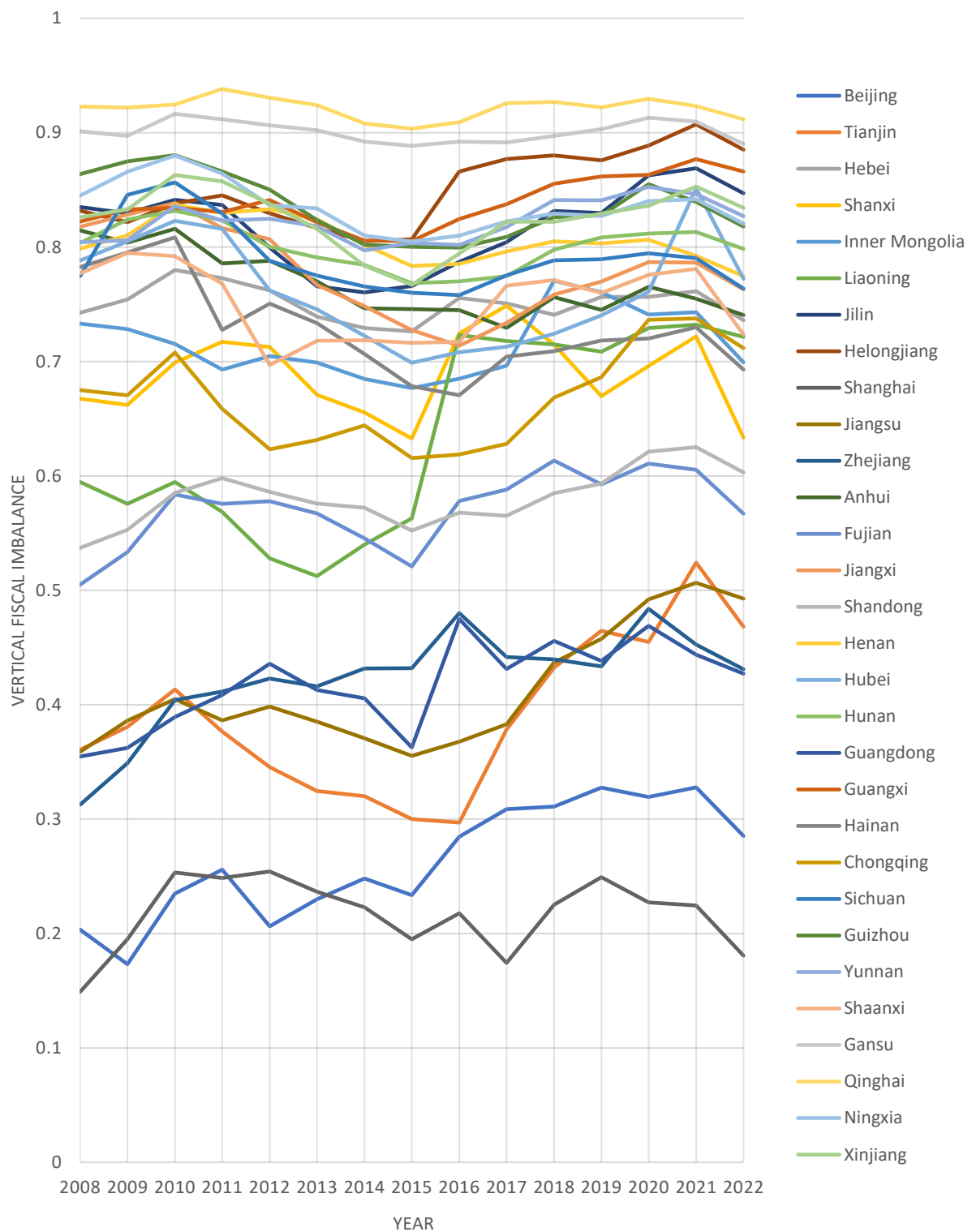


Figure 1.1 China's Vertical Fiscal Imbalance from 2008 to 2022

Sources: ① Original data from China National Bureau of Statistics (2023); ② Specific values calculated by the author using the formula in Table 3.2.

The concept of tax effort (Teffort) emerged in the 1950s, developing as countries, particularly developing nations, encountered challenges in achieving fiscal revenue targets. Teffort refers to the ratio of actual tax revenue achieved by a country or region under existing economic conditions to the theoretically achievable tax revenue (Chu et al., 2019). Researchers began to explore how to measure a country's actual tax capacity and compare it to its potential tax capacity. In the latter half of the 20th century, the International Monetary Fund (IMF) and the World Bank began incorporating the concept of Teffort into their studies and reports, aiming to help countries develop more effective and sustainable tax policies that foster economic stability and sustainable development. Fenochietto and Pessino (2013) evaluated Teffort levels by measuring the ratio of tax revenue to gross domestic product (GDP).

Figure 1.2 illustrates the temporal and regional variations in the tax effort index across 30 provinces in China from 2008 to 2022. In most years and provinces, the index hovers around 1, indicating that national tax collection generally aligns with the level of economic development. In the eastern provinces (such as Shanghai, Jiangsu, Zhejiang, and Guangdong), the tax effort index remains relatively stable and close to 1, reflecting that tax collection efficiency is largely consistent with the region's economic development. In contrast, the central and western regions (e.g., Heilongjiang, Jilin, and Shanxi) exhibit more pronounced fluctuations in certain years, which may be associated with fiscal pressure, changes in tax base structure, or tax policy adjustments.

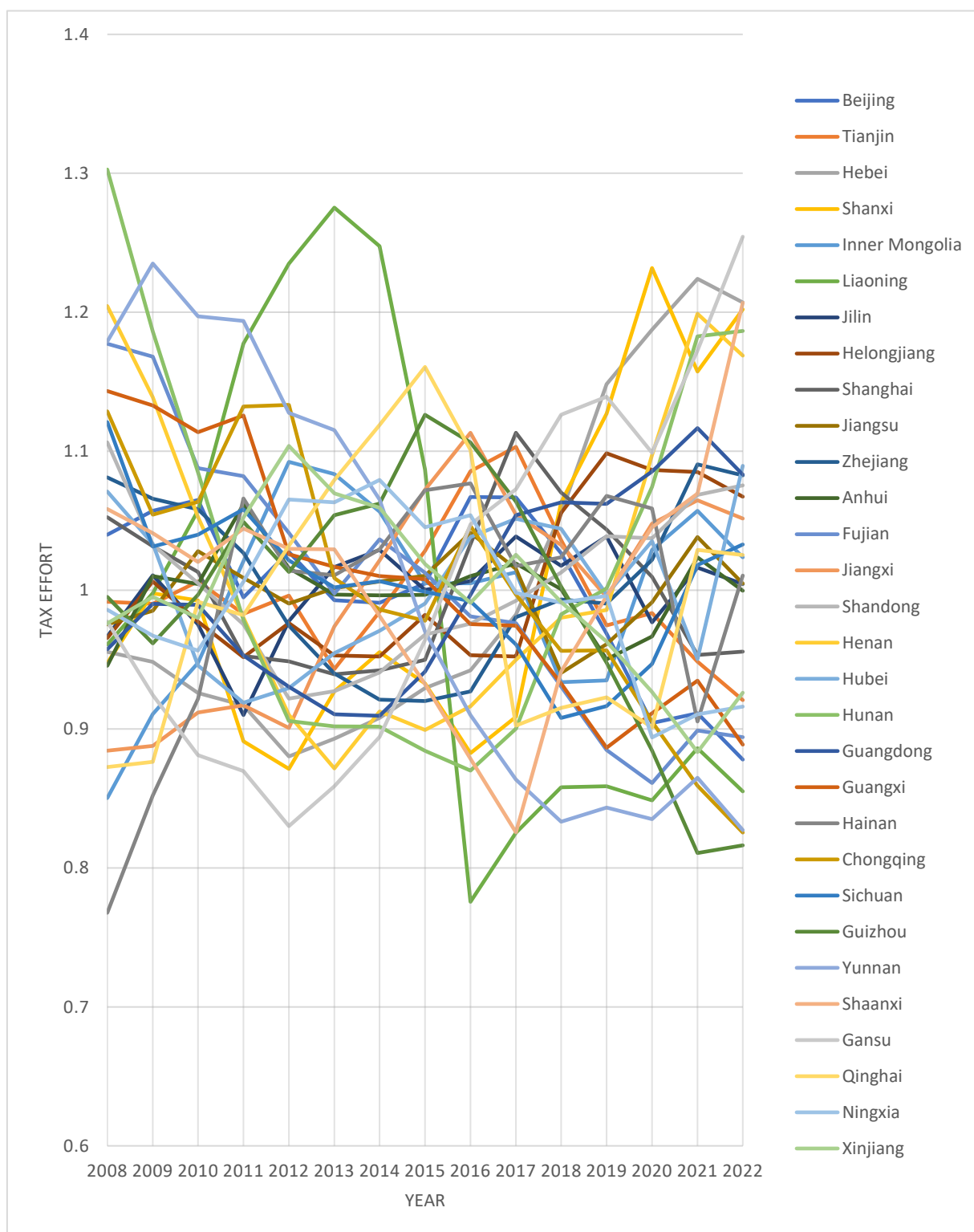


Figure 1.2 China's Tax Effort from 2008 to 2022

Sources: ① Original data from China National Bureau of Statistics (2023); ② Specific values calculated by the author according to the formula in Table 3.3.

The study of local government expenditure structure (Gstructure) originates in the early 20th century, developing alongside the establishment of current financial systems and national governance. Early public finance scholars focused on the economic effects and social impact of government expenditures, especially the division and utilization of fiscal resources and the allocation of fiscal responsibility among various levels of government. Local government expenditure structure refers to how local governments allocate and distribute their various expenditure items when executing fiscal budgets, including investment expenditure and livelihood expenditure. Chu and Shao (2018) used the percentage of livelihood spending in overall government expenditure to measure the bias in public expenditure structure. A higher proportion of livelihood expenditure indicates a smaller deviation from the value goals of people-centred governance, reflecting a more reasonable expenditure structure.

Figure 1.3 displays the ratio of livelihood-related expenditure to total fiscal expenditure across 30 provinces in China from 2008 to 2022. It reveals that the proportion of livelihood expenditure grew gradually between 2010 and 2015, followed by an accelerated increase after 2016. The eastern coastal provinces (such as Guangdong and Liaoning) exhibit a higher share of livelihood expenditure than the western provinces (such as Gansu and Ningxia), reflecting the correlation between the level of economic development and the structure of fiscal expenditure.

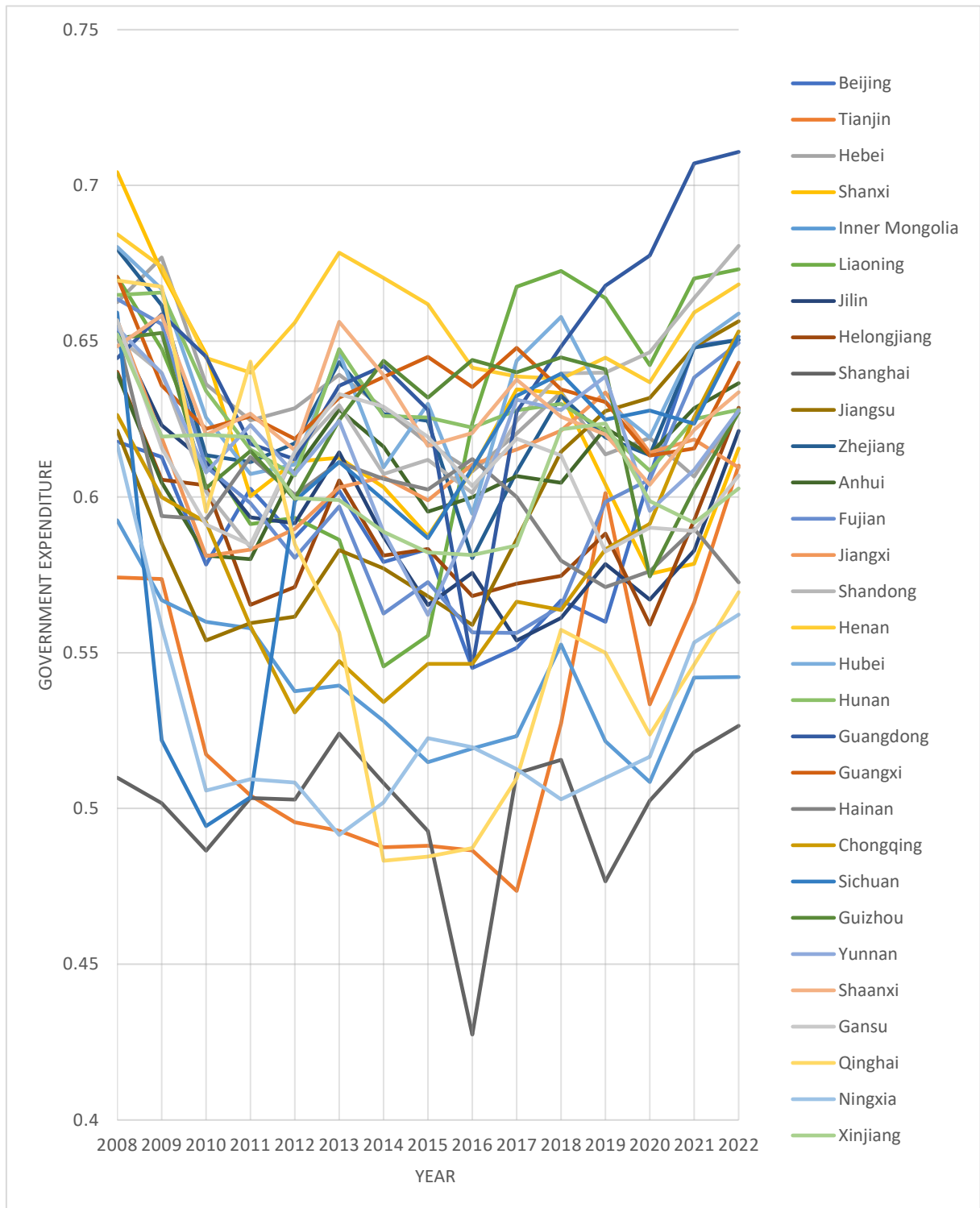


Figure 1.3 China's Expenditure Structure from 2008 to 2022

Sources: ① Original data from China National Bureau of Statistics (2023); ② Specific values calculated by the author according to the Formula 3.2.

Regarding the quality of economic development (Quality), Stiglitz and Fitoussi (2010) criticized the adequacy of GDP as a measure of Quality and social well-being. They pointed out that GDP focuses only on quantity rather than quality, neglecting negative externalities, wealth inequality, and the contributions of non-market activities. Therefore, they advocated for a broader set of indicators to assess the true Quality and social well-being. At the Fifth Plenary Session of the 18th Central Committee of the Communist Party of China, President Xi Jinping introduced detailed the Five Major Development Concepts: innovation, coordination, greenness, openness, and sharing development. These concepts encompass all dimensions of China's economic development and provide a critical foundation for scientifically evaluating Quality and developing an indicator system to measure it. This study adopts these five development concepts to scientifically measure five aspects of quality: innovation, coordination, greenness, openness and sharing (Chu & Shao 2018).

Figure 1.4 illustrates that the Quality in most provinces exhibits a steady upward trend, as reflected by the increasing height of the bars over the years. This indicates an overall improvement in the quality of economic development nationwide. The eastern coastal provinces (such as Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, and Guangdong) demonstrate significantly higher Quality than other regions. In some years, their indices exceed 4, reflecting strong economic vitality and development performance. In contrast, the central and western provinces (e.g., Heilongjiang, Jilin, Shanxi, Gansu, and Ningxia) exhibit lower overall Quality, with some years showing indices close to or below 0, indicating relatively lagging economic progress.

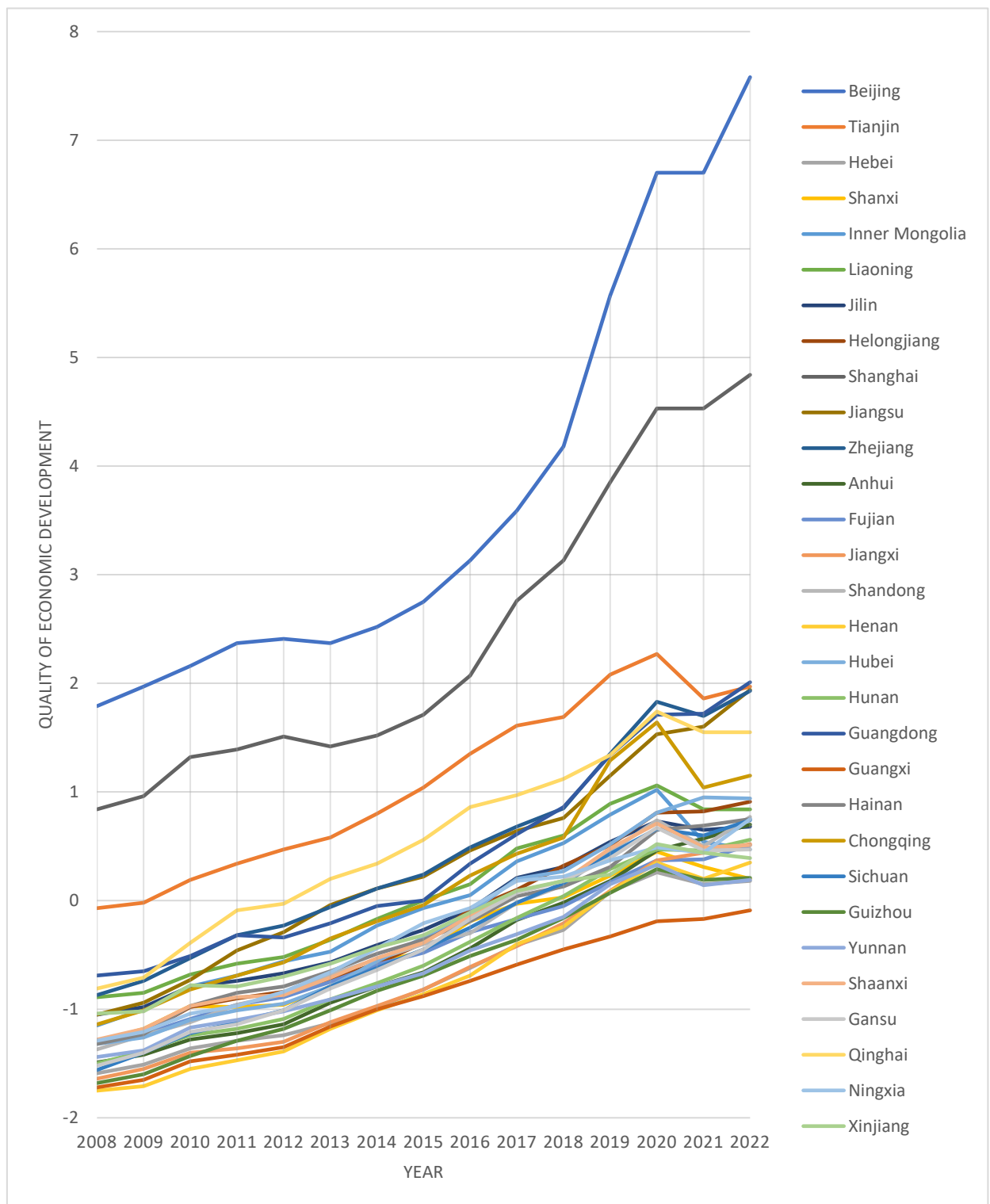


Figure 1.4 China's Quality from 2008 to 2022

Sources: ① Original data from China National Bureau of Statistics (2023); ② Specific values calculated by the author according to the formula in Table 3.1.

1.2.2 China's Fiscal System Reforms

The tax-sharing reform of 1994 established separate categories for central, local, and shared taxes, thereby strengthening the central authority's financial control to some extent. However, as the economic structure evolved and the financial needs of regional administrations increased, the growth in local government revenue remained relatively sluggish. Many local taxes, though nominally classified as local or shared, have an important portion of their revenue controlled by the central government. This imbalance in tax distribution has resulted in insufficient fiscal resources for regional administrations, which are in charge of public services and infrastructure development (Zhang & Gong, 2005; Jiang, 2007).

In 2012, China initiated a Value-Added Tax (VAT) reform, gradually integrating the business tax into the VAT system. This reform aimed to reduce double taxation, promote industrial upgrading, and foster the growth of the service industry. However, the shared nature of VAT meant that the reform led to a larger share of tax revenue flowing to the central government, leaving local governments with diminished income (Xie & Fan, 2015). This further exacerbated financial stresses on local governments.

In 2014, the Chinese government proposed another round of fiscal system reforms aimed at gradually addressing VFI by clarifying the budgetary and expenditure responsibilities of the national and local governments. Local governments were assigned more public service functions, including education, healthcare, social security, and

infrastructure construction. The expansion of these functions significantly increased the fiscal expenditure pressures on local governments (Jia & Ying, 2016). Although the reform emphasized the principle of matching fiscal powers with expenditure obligations, its effectiveness has been limited in practice due to the complex bargaining process between national and local governments.

In 2020, in response to the Covid-19 pandemic, the central government increased its support for local finances by raising the issuance quota for special bonds and expanding the scale of transfer payments. However, this system has encountered several issues in practice, such as a lack of transparency in the distribution mechanisms for transfer payments, inefficiencies in transfer payment implementation, and the increased dependency of local governments on these transfers. These problems have weakened the financial autonomy of local authorities and intensified VFI.

The current situation of VFI in China is the result of multiple factors, including historical issues and challenges arising from new economic developments and policy adjustments.

1.2.3 Vertical Fiscal Imbalance in China

In federal countries like the US, Germany, and Canada, the federal government typically addresses regional fiscal disparities through statutory transfer payments and matching funds. Local governments in these countries have greater autonomy in budgeting, tax collection, and expenditure allocation. They can formulate fiscal policies tailored to local

economic conditions and residents' needs, while the central government primarily influences local fiscal behaviour through legal frameworks and federal grants.

China's fiscal management approach, conversely, emphasizes central guidance and control over local governments. The central government usually frames fiscal budgets and expenditure plans, with local governments responsible for implementation. The central government also regulates local fiscal revenues and expenditures through mechanisms such as transfer payments and special funds, resulting in relatively limited fiscal autonomy for local governments (Zhao & Li, 2016). Central government intervention is particularly pronounced in major projects and cross-regional public services. A severe revenue-expenditure gap can lead to soft budget constraints, the phenomenon whereby economic agents can escape from their own budgetary constraints through external support (e.g., government bailouts, bank loan renewals, financial subsidies, etc.) when facing financial difficulties.

Thus, unlike most Western countries, where economic and political decentralization progresses simultaneously under fiscal federalism, China's fiscal system under unidirectional economic decentralization has created a reverse movement, with fiscal powers shifting upward while expenditure responsibilities devolve downward. This has led to a significant asymmetry in fiscal decentralization, characterized by low revenue decentralization and high expenditure decentralization (Li & Zhang, 2019). This institutional asymmetry has caused VFI between central and local governments, with the central government collecting more revenue and spending less, while local governments collect less

revenue and spend more. For instance, between 2008 and 2022, local government revenue rose from 45.93% of all revenue to 54.84%, but local government expenditure increased from 77.02% of all expenditure to 85.73%. This indicates a significant gap between local government revenues and expenditures, resulting in pronounced VFI. Meanwhile, the central government's share of revenues decreased from 54.09% in 2008 to 45.21% in 2022, while its share of expenditures dropped from 23.11% to 14.39% over the same period. This reflects an imbalance in the distribution of power and responsibility between the central and local governments, highlighting the increasing pressure on local governments to provide public services and bear fiscal responsibilities.

Local governments generally hold a negative view of vertical fiscal imbalances, especially when their fiscal revenues fail to meet growing expenditure demands. Local governments face significant pressure to meet the policy requirements of the central government while addressing public service needs and economic development tasks within their regions (Li et al., 2021). However, due to insufficient fiscal resources, many local governments struggle to fulfil these responsibilities, particularly in economically underdeveloped areas with more pronounced financial difficulties. In such cases, local governments hope that the central government will raise transfer payments and relax control over local taxation to alleviate fiscal pressure and promote regional economic development. However, in their relationship with the central government, local governments also face the challenge of balancing power and responsibility, especially in regard to improving the quality of local economic development without increasing fiscal risks.

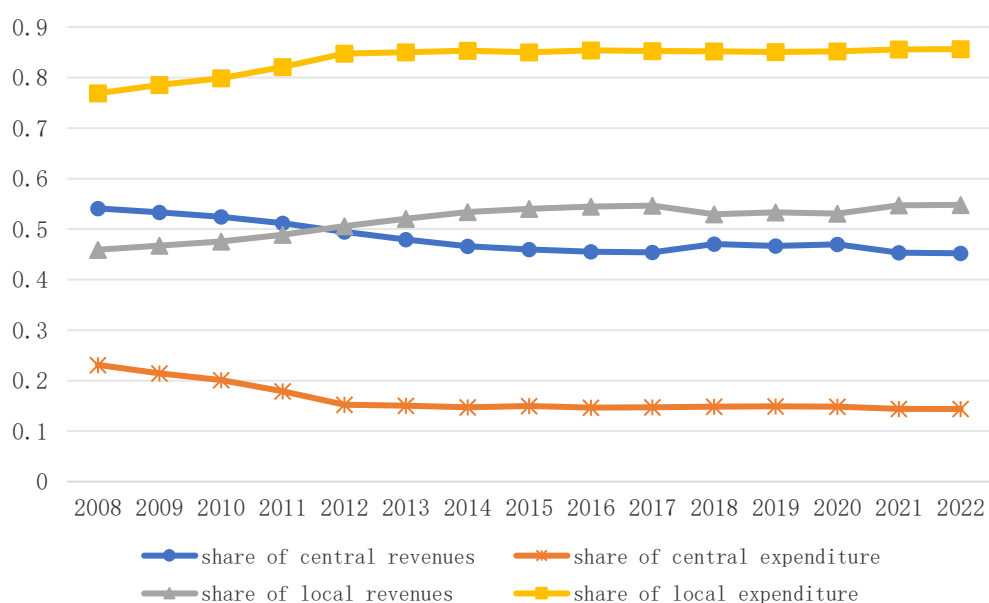


Figure 1.5 China's Fiscal Expenditure and Revenue Shares

Sources: ① Fiscal revenue and expenditure data for both central and local governments are obtained from China National Bureau of Statistics (2023); ② The percentage shares of central versus local government revenues and expenditures are computed by the author through proportional calculations.

Meanwhile, enterprises' views of vertical fiscal imbalances often focus on tax burdens and market conditions. Fiscal imbalances may lead local governments to pass fiscal pressures onto enterprises by raising taxes, increasing fees, or other means, potentially affecting the operating costs and competitiveness of businesses. At the same time, enterprises are concerned with government investments in infrastructure and public services, which are crucial for their long-term development. The primary goals of enterprises are to reduce their tax burdens, secure a favourable business environment, and receive stable public service support. Therefore, enterprises want local governments to have sufficient financial resources to invest in infrastructure, provide high-quality public services, and avoid offsetting fiscal shortfalls by raising taxes and fees (Lin & Sun, 2019).

Finally, the public's concerns about vertical fiscal imbalances mainly centre on the quality and accessibility of public services. Fiscal imbalances may lead local governments to cut spending on public services like education, healthcare, and social security, directly impacting the public's quality of life. The general expectation is for the government to manage fiscal resources more effectively to boost the quality of its services.

1.2.4 The Role of Fiscal Policy in National Governance

Fiscal decentralization theory studies the allocation of fiscal powers and resources within a multi-level government system. According to this theory, local governments should be granted greater fiscal autonomy to ensure their fiscal behaviour aligns more closely with the preferences of residents. By coordinating vertical fiscal relations between national and local governments to achieve a balanced fiscal system, the theory aims to enhance the welfare of residents within jurisdictions (Yu & Liu, 2018).

However, in China, for reasons of political management or macroeconomic stability, or to achieve social security goals, the institutional equilibrium under synchronous fiscal decentralization often results in the central government delegating expenditure obligations to lower governments while retaining control over fiscal revenues. As a result, the central government collects more revenue and incurs less expenditure, leading to a fiscal surplus, while local authorities collect less revenue and incur more expenditure, resulting in fiscal deficits. Consequently, local governments' own revenues do not match their expenditure

responsibilities, creating a mismatch between fiscal demands and the actual fiscal resources available to local governments (Bordignon et al., 2013).

The theory of local government competition posits that within a multi-level government system, local governments compete with each other to attract investment, stimulate the economy, and increase tax revenues (Bao et al., 2017). This competition can lead to the best distribution of resources and improved efficiency in public services. However, it may also result in a race to the bottom, where local governments reduce taxes or cut public services to attract businesses, ultimately lowering overall social welfare.

In the macro-institutional context of the socialist market economy, as the process of economic and social transition progresses, the inherent shortcomings of the market become increasingly apparent, and the government's role in macroeconomic regulation and control becomes more important. Fiscal policy is an essential pillar of national governance, playing a vital role in advancing the modernization of the national governance system and its capabilities (Lu & Wu, 2019). In recent years, major international institutions have continuously lowered their forecasts for global economic growth.

For example, at the beginning of the Covid-19 epidemic in 2020–2021, the International Monetary Fund (IMF) projected a 3.0% decline in the global economy. In 2022, the IMF revised its full-year global growth forecast downwards from 4.4% to 3.6%, mainly due to the Russian-Ukrainian conflict and energy price shocks. There was a further

downward revision for 2023, to 2.9%, reflecting the lagged effects of inflationary pressures and tightening of monetary policy.

To counter the downward pressure on the worldwide economy and ensure the stability of the domestic macroeconomic environment, China has implemented more proactive fiscal policies, including larger-scale tax cuts and fee reductions, to address global economic uncertainties and sustain steady economic growth. Positive fiscal policy is a short-term tool for coping with economic fluctuations, and without the support of a modern governance system, fiscal stimulus may fall into “policy idling”. Therefore, in the long run, promoting the high-quality development of China’s economy still needs to rely on institutional reform and the modernization of the governance system to optimize the efficiency of resource allocation, enhance the capacity of system supply, and improve the effectiveness of governance.

This demonstrates that deepening institutional reforms and improving the modern governance system have become key to advancing Quality in China. Given the fiscal system’s foundational role in the governance system, the extent to which fiscal system reforms are deepened will significantly impact, if not determine, the achievement of Quality goals.

Reviewing the progress of China’s fiscal and taxation system reforms since the 18th National Congress, the 2014 Overall Plan for Deepening Fiscal and Taxation System Reform emphasized maintaining the general stability of the national-local government revenue

structure while further rationalizing the division of revenue between national and local governments and establishing a system that aligns expenditure obligations with fiscal powers (Wang, 2016). The 2016 Guiding Opinions on Promoting the Reform of National and Local Fiscal Powers and Expenditure Obligations outlined the general requirements and principles for the distribution of fiscal authority and spending responsibilities, aiming to develop a modern financial and taxing system where fiscal powers align with expenditure responsibilities. In January 2018, the Notice on the Reform Plan for Dividing National and Local Fiscal Powers and Expenditure Obligations in Basic Public Services outlined the specific allocation of fiscal powers and expenditure obligations among national and local governments in the public services sector. This reform highlights the need to coordinate fiscal links among national and local governments, achieve regional fiscal balance, and find ways to optimize local government fiscal behaviour, thereby achieving steady growth in economic development and public welfare (Chu et al., 2019).

From the 19th Party Congress report, which emphasized the formation of a clear and distinct financial relationship between national and local governments, to the Fourth Plenary Session of the 19th Central Committee, which called for the improvement of mechanisms to fully leverage the creativity of both national and local governments, and the 14th Five-Year Plan, which proposed establishing a new fiscal and taxation system, the fundamental role a sound fiscal system will play in the new stage of Quality is growing increasingly evident. China's economy has entered a new phase focused on enhancing development quality, with the principal social contradiction now centred on the disparity between the public's

increasing demand for better living standards and the challenges of imbalanced and insufficient development. This shift highlights that the primary objective of China's current and future development is to elevate Quality and the standard of living (Liang, 2024).

Therefore, studying the impact of VFI on Quality in China is extremely important for the establishment and adjustment of financial strategies.

1.3 Problem Statement

A moderate level of VFI can be beneficial for strengthening the central government's control over local fiscal authority, advancing macroeconomic policy goals, and promoting healthy national economic growth. Moreover, moderate VFI can regulate local government fiscal behaviour, positively influencing local governance (Chu et al., 2020). However, as previously mentioned, China is currently experiencing a prolonged conflict within its vertical fiscal structure, which may hinder high-quality economic development and local governance (Liu & Zhang, 2022). While previous studies have focused more on the impact of VFI on economic growth, recent work has begun to focus on the impact of VFI on Quality through a single pathway, either through tax effort (Chu & Fei, 2021) or expenditure structure (Liu et al., 2023).

From the perspective of Quality, institutional deficiencies are evident. VFI compels local governments to rely on "land finance and debt financing" to bridge fiscal gaps. However, constrained by the deficit-to-GDP ratio limits stipulated in the Budget Law, funds are disproportionately allocated to productive sectors at the expense of public welfare and

innovation-related expenditures, thereby hindering balanced economic growth (Wang & Liu, 2021).

From the Teffort perspective, this pathway focuses on how resource extraction mechanisms affect Quality. Tax effort reflects the intensity with which local governments exploit tax potential within a given tax base. Persistent VFI conflicts can erode local fiscal budget constraints, amplify the common-pool effects of intergovernmental transfers, and ultimately suppress tax effort, jeopardizing fiscal equilibrium and sustainability (Ren, 2022). Investigating the indirect impact of VFI on Quality through tax effort enables policymakers to identify targeted governance leverage points in tax administration and design precision policies (Chu & Fei, 2021).

From the Gstructure perspective, this pathway emphasizes how resource allocation mechanisms influence Quality. Expenditure structure reveals fiscal preferences in allocating resources between productive investments and public welfare. Under China's top-down GDP-centric performance evaluation system, local officials engage in intergovernmental economic competition to secure career advancement, channelling limited fiscal resources into economic infrastructure—a practice that systematically distorts public expenditure patterns (Zhu & Liu, 2020). Analysing VFI's indirect effects via an expenditure structure allows for the identification through expenditure optimization of fiscal governance interventions, such as rebalancing allocations towards human capital and innovation.

Under the pressure of fiscal deficits, local governments tend to increase their fiscal

revenues through higher tax collection efforts to mitigate debt risks and maintain fiscal sustainability. At the same time, to achieve economic growth targets and broaden the tax base, local governments tend to invest more fiscal expenditures in productive areas with the aim of boosting investment and economic activities, which in turn bring more tax returns.

By comparing the indirect effects of these dual pathways, this study not only informs central policymakers in refining China's fiscal decentralization framework but also assists local governments in recognizing regionally differentiated transmission mechanisms, thereby facilitating tailored governance strategies. Specifically, this study addresses two critical questions: (i) How does VFI directly affect China's Quality? and (ii) Through what mechanisms—local governments' Teffort or Gstructure—does VFI indirectly influence Quality?

1.4 Objectives of the Study

1.4.1 General Objectives

The research objective of this study is to examine the impact of vertical fiscal imbalance on the quality of economic development in China from 2008 to 2022, with a focus on the roles of local government tax effort and expenditure structure.

1.4.2 Specific Objectives

The specific objectives are as follows:

1. To examine whether vertical fiscal imbalance directly affects the quality of economic development in China.

2. To explore whether vertical fiscal imbalance indirectly influences the quality of economic development in China through local governments' tax effort.

3. To investigate whether vertical fiscal imbalance indirectly affects the quality of economic development in China through local governments' expenditure structure.

1.5 Research Questions

To achieve these objectives, this study must address the following questions:

1. What is the direct effect of vertical fiscal imbalance on the quality of economic development in China?

2. How does vertical fiscal imbalance interact with local governments' tax effort to influence the quality of economic development in China?

3. How does vertical fiscal imbalance interact with local governments' expenditure structure to affect the quality of economic development in China?

1.6 Motivation of the Study

The concept of economic development has traditionally been seen as a unity of quantity and quality, with a primary focus on the quantity of economic growth, especially the overall amount and growth rate. Existing research has consistently prioritized the

quantity of economic development, with both theoretical and empirical studies centred on how to rapidly expand total economic output. However, the quality of economic development has long been neglected (Pan et al., 2021; Zhang et al., 2023; Ahmed & Elfaki, 2024). In economic practice, a range of issues have gradually surfaced, such as economic structural imbalances, significant income disparities, low resource utilization efficiency, and severe environmental pollution. This shift in economic realities has prompted some scholars to rethink their research approaches, incorporating these issues into the study of Quality. No longer solely concerned with increasing gross domestic product (GDP), these scholars have progressively engaged in in-depth research on how to enhance Quality.

The existing literature on the impact of VFI on China's economic and social growth primarily focuses on areas such as economic growth speed and path selection. These include studies on land financing behaviour (Xie et al., 2019; Wang, 2019), local debt accumulation (Baskaran, 2010; Guo et al., 2018), transfer payment adjustment strategies (Rodden, 2002; Yin & Zhu, 2009), and the modernization of state governance and improvement of governance capabilities (Lu & Li, 2018). While these studies provide valuable insights into specific aspects of VFI and its economic and governance implications, they tend to analyse these issues in isolation, lacking a comprehensive framework that integrates VFI, local government fiscal behaviour, and the quality of economic development.

Although some scholars have explored the relationship between VFI and Quality from different perspectives—such as local government financing constraints, expenditure

efficiency, or governance capabilities—they often focus on partial mechanisms rather than systematically examining how VFI shapes local fiscal behaviour and, in turn, affects Quality. For instance, research on land financing primarily discusses its role in revenue generation but does not fully integrate how VFI-driven incentives shape broader expenditure patterns and governance outcomes. Similarly, studies on transfer payments address redistribution mechanisms but rarely consider how they interact with local fiscal autonomy and Quality.

Single-pathway analysis captures only partial dimensions of VFI effects, such as efficiency losses or structural distortions. Dual-pathway analysis not only identifies the transmission channels of fiscal pressures and avoids mitigating model specification bias but also permits the identification of regionally differentiated transmission mechanisms through path coefficient comparisons, which provides a basis for categorical governance.

This fragmentation in the literature highlights the need for a unified analytical framework that systematically links VFI, local fiscal behaviour, and Quality. By addressing this gap, this study contributes to the literature by providing an integrated perspective that captures the interconnections between these factors and offers a more comprehensive understanding of their combined effects on economic development.

1.7 Contribution of the Study

Existing studies on VFI and economic development have largely focused on its effects on economic growth or local government financing behaviour, rarely providing a comprehensive framework linking VFI, local fiscal behaviour, and Quality (Liu & Zhang,

2022; Yao et al., 2024). For instance, Yao et al. (2024) primarily examined how VFI affects local government debt accumulation but do not consider its impact on Gstructure or Quality. Liu and Zhang (2022) explored the relationship between VFI and local government investment efficiency but fail to incorporate the role of Teffort or regional heterogeneity.

Therefore, this study uses a dual-pathway approach to examine both the direct impact of VFI on Quality and its indirect impact through changes in Teffort and Gstructure. This dual-pathway analysis not only enhances the explanatory power of the model but also allows for the identification of regionally differentiated transmission mechanisms. The findings provide a solid empirical foundation for more precise fiscal decentralization and governance reforms.

Moreover, while previous studies have explored the impact of VFI on economic growth at the national level, they have rarely considered its heterogeneous effects across regions (Song et al., 2021; Chu & Fei, 2021). For example, Song et al. (2021) analysed the impact of VFI on China's GDP growth but overlook the regional disparities in fiscal autonomy and marketisation. Chu and Fei (2021) investigated the fiscal decentralization effects on local economic performance but fail to differentiate between the eastern, central, and western regions.

This study addresses this gap by conducting both national- and regional-level analyses, revealing how fiscal imbalances have differentiated impacts due to regional variations in marketisation and fiscal autonomy. The eastern region, with a higher degree of

marketisation, demonstrates a stronger capacity to absorb fiscal pressures, while the central and western regions, which are more reliant on transfer payments, experience greater fiscal vulnerability. The findings of this study offer valuable policy insights for optimizing fiscal system reforms. By clarifying the specific transmission pathways through which VFI influences local fiscal behaviour and development quality, the central government can refine its fiscal policy design to promote regionally balanced development. Additionally, local governments can leverage the findings to optimize their Teffort and Gstructure, thereby enhancing Quality in their respective regions.

The last contribution is that this study combines the theory of fiscal federalism to propose a new analytical perspective that explains how VFI indirectly affects Quality by influencing local fiscal behaviour. Since the impact of VFI is not unidirectional but depends on the local economic environment and fiscal structure, this provides theoretical support for future fiscal decentralisation and governance optimisation.

1.8 Organization of the Study

The study is arranged into five chapters. Chapter One is an introduction. First, this chapter fully expounds the research background of this topic based on the proposition of economic development goals leading to high quality. Secondly, it analyses the gap between the ideal state and reality, proposes the research problems of this study, and determines the objectives and problems. Finally, it summarizes the significance of the study.

Chapter Two provides an in-depth exploration of the relevant literature, with two main sections, the theoretical review and the empirical review. The theoretical review analyses key theories such as fiscal decentralization, VFI, Quality, and tax competition in detail. The empirical review focuses on exploring the direct link between VFI and Quality, and further examines how Quality can be affected by adjusting the fiscal balance of local governments. According to these theoretical and empirical reviews, this chapter proposes seven hypotheses for the study. This chapter lays a solid foundation for further research and provides readers with deep insights into the relevant topics.

Chapter Three delves into the design and methodology of the study. It presents the framework of the study, along with clear definitions and measurements of the variables involved. This chapter also thoroughly explains sources of data. Finally, it describes in detail the models and methods used in the study and applied in the actual data analyses in order to validate the hypotheses and derive insights regarding the research questions.

Chapter Four introduces the regression model of VFI, Teffort, and Gstructure on Quality, followed by regression tests to answer the research questions. In addition, this chapter also analyses the empirical results and compares the influence effects.

Chapter Five summarizes the research conclusions and puts forward policy suggestions. First, this chapter systematically sorts out the relevant theories and empirical analysis in Chapters Two and Four and briefly elaborates on the main research conclusions. Second, based on the research conclusions, it puts forward relevant policy recommendations.

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

This chapter comprises four main sections: a theoretical review, an empirical review, research gaps, and research hypotheses. The theoretical review begins with the theory of fiscal decentralization and the resultant theory of VFI. It then proceeds to discuss the concept of, development of, measurement indicators for, and methods related to Quality, as well as the two branches of tax competition theory. The empirical review explores the literature on the relationship between VFI, Teffort, Gstructure, and Quality. After analysing the literature, the chapter identifies research gaps, then formulates research hypotheses.

2.2 Theoretical Literature

This section includes theories relevant to this study, such as fiscal decentralization theory, vertical fiscal imbalance theory, economic development quality theory, and tax competition theory.

2.2.1 Theory of Fiscal Decentralization

Fiscal decentralization theory was a significant concept in modern public economics. It referred to the delegation of certain taxing powers and expenditure responsibilities from the central government to local governments, allowing them to independently determine the scale and structure of budgetary expenditures to better provide public services. Existing

fiscal decentralization theories can be broadly divided into two generations: first-generation decentralization theory and second-generation decentralization theory.

- The First Generation of Fiscal Decentralization Theory

First-generation fiscal decentralization theory emerged in the 1950s, primarily to explain the rationales and necessities of local governments. It sought to answer why, in pursuit of maximizing social welfare, it was not feasible for the central government alone to supply public goods based on resource endowments and residents' preferences. Using the framework of neoclassical economics, first-generation fiscal decentralization theory focused on the definition of and necessity for fiscal decentralization, particularly the comparative efficiency of resource allocation between central and local governments. Key theories included Tiebout's "voting with one's feet" hypothesis (Tiebout, 1956), Musgrave's decentralization concept (Musgrave, 1959), Buchanan's club theory (Buchanan & Tullock, 1965), Oates' decentralization theory (Oates, 1972), and Tresch's preference misrecognition theory (Tresch, 1981). These theories provided explanations and rationales for fiscal decentralization from various perspectives and discuss how to reasonably allocate fiscal functions and instruments amongst different levels of government. Their core argument was that because local governments are closer to the public, they had a greater knowledge of their residents' needs and preferences. Consequently, local governments were better suited to delivering public goods and services, thereby enhancing resource allocation efficiency and improving social welfare.

However, the validity of these conclusions rested on two fundamental assumptions: first, the benevolent government assumption, which posited that local governments aimed to maximize social welfare through their fiscal actions; second, the assumption that local governments had distinct advantages over the central government in the provision of local public goods. The latter had been discussed from multiple dimensions in traditional fiscal decentralization theory. Hayek (1945) first articulated that local governments had a relative information advantage in public goods provision. The multi-level governance system led to delays and distortions in information transmission, inevitably wasting resources and increasing transmission costs. Compared to the central government's high information acquisition costs, local governments had an information cost advantage when seeking to understand the needs and preferences of their residents. Hence, allowing local governments to supply localized public goods can reduce the costs associated with public goods provision. Stigler (1957) and Tresch (1981) also supported similar views. Additionally, Stigler (1957) established that voting mechanisms provided local governments with effective channels to gather preference information and supplied desirable public goods.

In the classic work "A Pure Theory of Local Expenditures", Tiebout (1956) systematically explained how the division of powers among central and local governments can more efficiently supply public goods. In so doing, Tiebout (1956) introduced the classic "voting with one's feet" mechanism. Due to their non-excludability and non-rivalry, public goods were more appropriately supplied by the central government. Simultaneously, public goods with limited beneficiary scopes, such as education, healthcare, and fire protection,

were more effectively supplied by local governments. Under the assumption of the free movement of residents and factors, residents would choose their place of residence by weighing the benefits obtained from public goods against the costs reflected through taxes. To attract factor inflows and prevent tax base erosion, local governments would improve public goods provision efficiency and engage in regional competition. Tiebout's classic analysis laid the theoretical foundation for fiscal decentralization and had been widely adopted in subsequent research.

Besides Tiebout, other scholars had also interpreted the rationale and advantages of local governments providing certain public goods from different perspectives. Musgrave (1959) re-examined how government functions should be allocated among national and local governments. He argued that due to financial constraints and factor mobility, local governments cannot fulfil the roles of macroeconomic stability and wealth redistribution. However, they can influence resource allocation by providing public goods that the market fails to effectively allocate. Additionally, Oates (1972) pointed out that national public goods should be provided by the central government, while public goods benefiting local residents should be supplied by local governments.

Overall, first-generation decentralization theory primarily emphasized the advantage of local governments in understanding residents' public demand preferences, enabling them to provide desirable public goods more efficiently than the central government. Moreover, the theory underscored the need to match tax authority with local governments' expenditure responsibilities to meet the financial demands of providing public goods. Nonetheless,

although first-generation fiscal decentralization theory offered strong theoretical support for intergovernmental decentralization, it had faced criticism since its inception. Critics argued that its assumptions were too stringent (e.g., the complete mobility of factors and people, perfect information in Tiebout's model), rendering the theory less applicable to reality and throwing into question its validity. Others criticized the theory for neglecting the incentives of government officials, thus treating the government as a black box, as in the neoclassical firm theory, and assuming that the government was benevolent and naturally provided public goods and protected the market (Qian & Weingast, 1996). Finally, the theory's relevance to developing countries had been questioned, as it primarily addressed the efficiency of public goods provision rather than issues of economic growth and development, although some scholars (Zhang & Shen, 2008; Zhou & Zhang, 2008) had argued that it supported the idea that fiscal decentralization promoted economic growth from the perspective of optimizing resource allocation.

- The Second Generation of Fiscal Decentralization Theory

The limitations of first-generation fiscal decentralization theory gave rise to a second-generation evolution of it. Unlike the first generation, which focused on the effective provision of public services, the second generation shifted its focus to the behaviour of local governments and its influence on economic growth. Scholars had integrated insights from public choice theory and principal-agent theory into the framework of first-generation fiscal decentralization, gradually forming what was now known as second-generation fiscal decentralization theory.

In public choice theory, government officials were akin to professional managers, whose primary objectives were election victories and budget maximization. Their self-interested behaviour may, however, diverged from the public interest. Thus, the first-generation theory's assumption that governments were inherently benevolent might be overly idealistic. Furthermore, second-generation theory incorporated the analysis of incentive and constraint mechanisms from principal-agent theory, arguing that central and local governments, along with their officials, were embedded within complex chains of principal-agent relationships. Without effective incentives and constraints, local governments might participate in profit-seeking and other behaviours that failed to reflect public interests. Therefore, it was important to introduce necessary incentive mechanisms and governance structures to ensure that local governments maximized social welfare.

Additionally, second-generation theory emphasized the institutional incentives that drove local governments to promote economic development. In particular, it highlighted how decentralization fostered a system of market-preserving federalism, where fiscal incentives encouraged local governments to actively pursue economic development and optimization (Qian & Roland, 1998; Qian & Weingast, 1996).

Compared to the first-generation equivalent, the second-generation theory could better explain the tendencies and evolution of local government behaviour in China. It offered a robust framework for understanding China's growth miracle from a decentralization perspective. On one hand, it explained the clear fiscal spending preferences of local governments and their officials under biased incentives. On the other hand, the

theory expanded the discussion beyond the simple debate of centralization versus decentralization, placing government actions within the context of achieving specific goals. After evaluating the net benefits of decentralization and centralization, the theory assessed the desirability of a particular degree of decentralization. Furthermore, it emphasized the importance of regulating the government through incentive and constraint mechanisms and political structures (Yang & Nie, 2008).

Despite the explanatory power of both first- and second-generation theories for China's fiscal decentralization practices, particularly when analysing the link between fiscal decentralization and economic performance, they fell short in precisely describing the unique characteristics and effects of fiscal decentralization. As a result, some researchers had explored the specific features of fiscal decentralization in China, attempting to distil theoretical insights from China's practical experiences. Compared to the strict theoretical assumptions, Chinese fiscal decentralization exhibited uniqueness in four main aspects. (i) Fiscal decentralization was closely integrated with administrative decentralization, with a hierarchical and subordinate relationship between them. (ii) Local governments had a comparatively substantial role in spending decisions, coupled with significant expenditure responsibilities. (iii) Fiscal revenues were highly controlled at the central government level, with local governments enjoying almost no decision-making power over tax types, bases, or rates. (iv) There was a considerable gap in local government finances, primarily filled by central government transfers and self-sourced local revenues (Gong & Lei, 2010).

From the view of national governance, Lu and Li (2018) argued that China's fiscal decentralization system should no longer be viewed as a simple fiscal issue. The vertical fiscal imbalance created by China's decentralization was the result of a coupling between political and fiscal incentives, improving performance in national governance. Overall, it was evident that numerous theoretical studies had identified distinctive differences between China's fiscal decentralization system and classic fiscal decentralization theory, with many emphasizing the unique role of political systems and political incentives in shaping China's fiscal decentralization system.

- Chinese-Style Theory of Fiscal Decentralization

In the context of China, scholars had developed a theory of Chinese-style fiscal federalism by examining the issue of decentralization and intergovernmental fiscal relationships (Montinola et al., 1995; Qian & Roland, 1998). They classified China's intergovernmental fiscal relations as market-preserving fiscal federalism, arguing that administrative and fiscal decentralization were key factors motivating local governments to boost economic development. First, the delegation of economic management authority had provided local governments with some degree of decision-making authority. Second, fiscal decentralization reforms had granted local governments substantial financial resources. These dual aspects of decentralization had fully mobilized local governments' incentives to protect markets and develop the economy.

However, this theory struggled to explain why fiscal decentralization in China encouraged local governments to act as helping hands, while in Russia, decentralization led to grabbing hands. In response to the differing outcomes of decentralization in China and Russia, Blanchard and Shleifer (2001) suggested that China's fiscal decentralization was combined with a politically centralized system, making local governments accountable upward, rather than being captured by regional interest groups. Zhou (2007), meanwhile, pointed out the limitations of the theory of Chinese-style fiscal decentralization for explaining China's economic development. He noted that the distribution of administrative power and economic management authority among national and local governments was continuously adjusted and did not always benefit local governments. Administrative and fiscal decentralization alone cannot ensure that local governments had strong incentives to protect markets. However, the passion of local governments for promoting economic growth had not been considerably affected, indicating that there was a more fundamental driving force behind local government behaviour beyond administrative and fiscal decentralization.

Consequently, Zhou (2004) proposed the famous Promotion Tournament Theory. This theory posited that China's economic decentralization was complemented by political centralization, where a vertically integrated political management system and a performance evaluation mechanism centred on GDP had provided local government officials with strong political motivations to boost their own economies. Although the explanatory perspectives of fiscal decentralization and promotion incentive mechanisms differed, their logical pathways were unified.

Therefore, scholars had integrated fiscal decentralization and the promotion mechanism into a unified theoretical framework of Chinese-style decentralization, thus forming Chinese-style decentralization theory (Fu & Zhang, 2007; Wang et al., 2007). China's economic growth miracle had largely been attributed to the Chinese-style decentralization system, characterized by relative political centralization and economic decentralization. The argument was that on the one hand, political incentives based on performance evaluations had motivated local governments to actively transform into growth-oriented governments, while on the other hand, economic decentralization had endowed local governments with the monetary assets and means to stimulate economic growth within their jurisdictions.

2.2.2 The Theory of Vertical Fiscal Imbalance

Since the 1994 tax-sharing reform, China had gradually developed a trend of centralizing fiscal power while decentralizing responsibilities. With the deepening of fiscal and tax system reforms, however, the expenditure responsibilities among different levels of government had not been adjusted in line with changes in central and local revenue distribution, leading to vertical fiscal imbalance. This phenomenon had garnered significant attention from scholars.

● Genesis of the Theory of Vertical Fiscal Imbalance

The issue of VFI was inherently linked to China's governance needs and functional mechanisms. In China's authoritative system, the central government had all the authority,

with two primary objectives. First, it aimed to maintain long-term stability and provide basic government services for all citizens. Second, it ensured the effective implementation of central directives, preventing the misuse of power by local agents. However, these two goals were often in conflict, referred to as the tension between the authoritative system and effective governance (Zhou, 2011).

◆ Based on Effective Governance: Decentralization of Administrative Responsibilities

First, due to China's wide geography, large population, and significant economic inequalities across regions, governance tasks were highly decentralized and complex. The central government oversaw national affairs but struggled to directly manage local matters, necessitating local decentralization to reduce administrative costs and improve governance efficiency (Zhang & Chen, 2007). Through an allocation of labour among national and local governments, each could leverage its strengths to form an efficient governance system. Local governments, being closer to the populace, were more efficient in providing public services (Musgrave, 1959; Oates, 1972; Stigler, 1957; Tiebout, 1956).

Second, in China's vertical fiscal relationship, the central government maintained political stability by controlling fiscal reforms and local decentralization. According to Cao (2014), to gain public support, the central government avoided direct conflicts with local residents and delegated related matters to local governments. This granted local governments the power to govern their people, creating a system where the central government governed

officials while local governments governed the populace. This effectively dispersed ruling risks, preventing national-level crises and enhancing political stability.

◆ Based on the Authoritative System: Centralization of Fiscal Power

First, under China's territorial management system, local governments had significant discretionary power and were responsible for specific policy implementation (Zhou, 2014). This separation of decision-making and execution allowed local governments to engage in creative practices, potentially leading to superficial and formalistic behaviour. Local governments were connected to both the central government and the populace, playing a dual role that significantly impacted central governance performance. When local decision-making power expanded, deviations from central policy intentions might occur, potentially challenging the authoritative system.

Second, under China's fiscal decentralization system, local governments became independent entities pursuing their own interests, which might conflict with public interests. Local governments often expanded their power and exceeded budget constraints (Zhou, 2005). Due to limited central oversight and inadequate horizontal supervision mechanisms, local people's congresses lacked the capacity to regulate local governments' deviant behaviour, leading to regional power centralization (Cao, 2014). This might further exacerbate local governments' deviation from central intentions and public interests.

◆ Based on Dynamic Coordination of Central-Local Relations: Vertical Fiscal Imbalances

In response to the complexities of national governance, the central government employed the following strategies. First, it flexibly utilized both formal and informal institutions. The central government adopted formal institutions when maintaining authority and achieving fiscal objectives and informal institutions when it allowed local governments decision-making space without undermining central authority. When necessary, the central government could adjust the relative levels of the two to seek a balance of public power. Second, it balanced policy uniformity with local flexibility in implementation. While maintaining macro-control over policies, the central government allowed local governments to adapt policies based on local circumstances and strengthened oversight to correct deviations promptly. Third, through economic transfer payment systems and political campaign-style governance, the central government enforced its authority, maintaining governance flexibility and efficiency. The central-local relationship was the foundation of national governance. Vertical fiscal imbalance was a result of the central government seeking a balance between authoritative systems and effective governance. This design considered economic efficiency and was a rational choice for maintaining political stability, adjusted according to changing governance needs.

- Connotation of the Theory of Vertical Fiscal Imbalance

In the evolution of fiscal decentralization theory, the first-generation theory advocated for greater fiscal autonomy for local governments, while the second-generation theory introduced the assumption of local government as economic agents, challenging the benevolent government hypothesis. Despite changes in theoretical assumptions, the core

issue remained how to grant local governments more fiscal autonomy within a centralized governance framework, thereby encouraging their independence and initiative in public affairs management and public goods provision. The aim was to balance the vertical fiscal relationship between national and local governments, thus enhancing or improving the wellbeing of citizens in their boundaries. However, in practice, fiscal system reforms in many countries had shown that this balance was difficult to achieve. Ideally, fiscal power and expenditure responsibilities should be decentralized simultaneously. In reality, however, due to the need for national governance, macroeconomic stability, and overall social welfare, spending obligations were often transferred to local governments, while fiscal power remained centralized, causing a mismatch among regional governments' own revenues and their expenditure responsibilities, and in turn leading to VFI (Bordignon et al., 2013). As the central government was seen as the ultimate allocator of national public resources, a certain degree of vertical fiscal imbalance was considered inevitable and rational (Persson & Tabellini, 1996), as it helped local governments balance equity and efficiency. However, excessive vertical fiscal imbalance beyond an optimal threshold could negatively impact local government autonomy (Oates, 1993).

In 1973, Wagner first proposed the concept of VFI, which was later formalized by Hettich and Winer (1986). They argued that VFI occurs when the central government had excessive revenue while state governments faced significant funding needs. Hunter (1977) explained VFI based on the revenues governed by national and local governments, stating that when the central government controlled more revenue than local governments, the

economy was in a state of VFI. Breton (1989) suggested that an imbalance among revenues and necessary spending at different levels of government led to resource allocation inequities, resulting in a vertical fiscal imbalance. Bird and Tarasov (2004) posited that vertical fiscal balances existed when local governments' expenditures and revenues (including transfers) were in budgetary balance; otherwise, vertical fiscal imbalance occurred. Tremblay and Boadway (2006) pointed out that VFI arose when central government transferred to localities were insufficient to cover the expenditures assigned to them, leaving local governments with significant fiscal gaps. Dahlby and Wilson (1994) analysed vertical fiscal imbalance from two perspectives. First, in 1994, they proposed that when the marginal costs of raising funds were equal across all levels of government, vertical fiscal balance existed. Second, in 2005, they corrected a common misconception that budget balance between different levels of government at a given time did not imply fiscal balance; instead, they argued, one should assess fiscal balance by comparing the marginal benefits and costs of government expenditures. If these were equal, then vertical fiscal imbalance was absent. Boex and Martinez-Vazquez (2006) argued that vertical fiscal imbalance arose from unequal fiscal capacities between governments and suggested that transfer payments could serve as a policy tool to correct vertical fiscal imbalance and further promote fiscal balance.

China's fiscal system reform was based on administrative decentralization. Thus, while the central government had concentrated substantial fiscal revenues more than in the pre-reform period, the responsibilities for expenditure borne by local governments had not been correspondingly adjusted. This contradiction between the restricted autonomous

financial revenue of local governments and their increasing expenditure responsibilities reflected a systemic imbalance in the fiscal relationship between the central and local governments. This phenomenon was defined as VFI (Chu & Shao, 2018). Li and Zhang (2019) argued that VFI in China was the result of reforms during which expenditure responsibilities were not adjusted in line with intergovernmental revenue distribution. The imbalance was characterized by the central government's control over excessive revenue while intervening excessively in local issues via transfer payments. The centralization of financial control, coupled with the decentralization of responsibilities, created an inherent imbalance among regional government spending and revenue, leading to an inevitable fiscal imbalance and triggering VFI (Cai & Chen, 2023; Liu et al., 2024).

In summary, this study defined the concept of VFI in China as the uneven allocation of fiscal responsibilities, fiscal power, execution responsibilities, and spending obligations among the central and local governments within the context of China's political centralization and administrative decentralization system. This imbalance resulted in a scenario where the central government concentrated substantial fiscal revenue while bearing fewer public expenditure responsibilities, whereas local governments were allocated fewer discretionary fiscal resources but were responsible for the majority of public expenditures. A summary of the connotations and development of VFI was shown in Table 2.1.

Table 2.1: Internal Development of Vertical Fiscal Imbalance

Author(s) (year)	Implications of vertical fiscal imbalances
Wagner (1973)	There is a vertical fiscal imbalance between the central government, which has too many sources of revenue supply, and the state governments, which face strong demand for funds.
Hunter (1977)	Misalignment of revenues between central and local government control.
Hettich and Winter (1986)	Excess revenue supply exists in central government, while local government gaps have fewer sources of funding and excessive demand for funds.
Breton (1989)	The mismatch between revenues received and necessary expenditures at different levels of government.
Dahlby and Wilson (1994)	The marginal cost of raising funds is equal at all levels of government in a country.
Bird and Tarasov (2004)	The imbalance between fiscal revenues received by local governments and necessary expenditures.
Tremblay and Boadway (2006)	Revenues transferred to the provinces by the federal government are far from sufficient to finance provincial expenditures.
Boex and Martinez-Vazquez (2006)	Arising from the imbalance of financial resources between Governments.
Chu and Shao (2018)	Central government focuses a huge amount of revenue while local governments take on more expenditure responsibilities.
Li& Zhang (2019)	Government expenditure responsibilities have not been adjusted in tandem with the distribution of income among governments.
Cai and Chen (2023)	Centralization of financial power and decentralization of affairs has resulted in a natural mismatch between local government revenues and expenditures.
Liu et al. (2024)	The upward shift of financial power is concentrated in the central government and the decentralization of power is concentrated in local governments, creating a vertical fiscal imbalance.

2.2.3 Theory of Economic Development Quality

● Connotation and Development of Economic Development Quality

During the 19th National Congress of the Communist Party of China, General Secretary Xi Jinping, standing at a new historical juncture, innovatively introduced the concept of economic development quality. He emphasized that economic development

quality was characterized by low resource costs, minimal factor inputs, high social benefits, and efficient allocation. In this study, Quality encompassed but was not limited to concepts like the quality of economic development, quality of economic growth, and high-quality economic development found in existing studies. These were collectively referred to as economic development quality, and a summary of representative research was provided in Table 2.2.

Table 2.2: Combing the Context of Quality Theory

Topics	Author(s)	Year	Key points
Quality of economic development	Xu	1998	In essence, the connotation of Quality is a concept of efficiency. The amount of economic development is mainly reflected in economic structure and economic growth mode.
	Leng	2008	Starting from effectiveness, sustainability, innovation and sharing of economic development, energy consumption, and other indicators are selected to measure Quality in China.
	He	2013	The quality connotation of economic development is defined from six aspects: sharing, effectiveness, innovation, stability, sustainability and coordination.
Quality of economic growth	Kamaev	1977	The sum of the changes in the material means of production, as well as the increase in the quantity of products, is called the economic growth of the economic and social structure.
	Dornbush & Fisher	1978	Factor productivity, the more efficient use of capital and labour and the application of science and technology, is the main source of Quality.
	Thomas et al.	2000	As a supplement to the growth rate, the quality of growth is the key content of the growth process, such as the optimal allocation of resources and environmental sustainability.
	Barro	2002	Besides economic growth, social, political and institutional factors play an important role in economic growth, and their improvement is the quality part besides economic growth.
	Zhao et al.	2006	Theoretical connotation of Quality: Output ratio of economic system input; Quality of final products and services; Environmental quality, quality of life.
	Chao & Hui	2009	The index system is constructed from four aspects: growth stability, structure, effectiveness and ecological cost.
	Chao & Ren	2011	The quality extension of economic growth is defined from four aspects of growth stability, structure, effectiveness and ecological cost.
	Tridico	2011	Development is a special kind of economic growth that promotes employment, changes the lives of animals, and achieves fairness and equal opportunity.
	Yu et al.	2019	The green TFP is selected to measure the quality of economic growth, and the regional differences of China's high-quality growth are deeply analyzed.

Table 2.2 continued

Topics	Author(s)	Year	Key points
High-quality economic development	Jin	2018	High-quality development can effectively reflect the people's needs for growth of interest and is reflected in the driving force, structure and mode of economic development.
	Liu et al.	2018	High-quality development is a state of "high level" of economic development quality.
	Ren	2018	The theoretical orientation of high-quality development is to improve the effectiveness of supply, realize fair development, ecological civilization and human modernization.
	Tian	2018	High-quality development is a kind of development concept, mode and strategy, which takes quality as the value orientation, task orientation and core goal.
	Ren & Li	2018	The key to high-quality development is to solve the problem of unbalanced and inadequate development. The path for China's economy to transition from high-speed growth to high-quality development in the new era is to build a modern and high-quality economic system.
	Han et al.	2019	High-quality economic development is reflected in the production link of low input, low pollution and high level of governance, consumption link of people-oriented.
	Lin	2020	High-quality economic development aims to meet the people's ever-growing needs for a better life. It reflects the five new development concepts and measures the comprehensive results of input-output, environmental protection, social benefits and resource allocation.
	Zhang et al.	2021	The key to high-quality economic development is the word quality. The goal is to meet the people's needs for a better life, which is embodied in the five development concepts.
	Deng et al.	2021	An integrated system is designed to measure the high-quality development level from five aspects: transformation of growth drivers, optimization of industrial structure, upgrading of demand structure, improvement of efficiency, and optimization of development environment.
	Zhou et al.	2022	Based on the panel fixed-effects model, a four-tier index system for high-quality economic development in China is constructed from the four dimensions of the economic system, social system, environmental system, and power system.

A comprehensive review of existing studies, as outlined in Table 2.2, revealed that scholars mainly defined economic development quality from perspectives such as economics, new development concepts, input-output analysis, and supply-demand dynamics.

First, from an economic standpoint, early studies by economists such as Solow (1956), Jorgenson and Griliches (1967), and Kamaev (1977) examined the quality of economic growth without providing a clear definition. They merely pointed out the need to study factors beyond economic growth and highlighted the importance of considering both the speed and efficiency of economic growth. Jin (2018) analysed high-quality development based on normative economics, suggesting that it aimed at meeting people's expanding needs, which was evident in various aspects of economic development, including its drivers, structure, and methods. High-quality development was also seen as more comprehensive, coordinated, stable, and sustainable (Ren, 2018; Tian, 2018). Ren and Li (2018) argued that high-quality development encompassed not just high-quality economic development but also high-quality living standards, environmental quality, urban and rural construction, and reform progress.

Second, research focused on economic growth quality from an efficiency perspective. Scholars like Lucas (1988) shifted attention towards assessing economic development quality from multiple angles, including society, the environment, and human capital. High-quality development was considered a new development philosophy that prioritized quality and efficiency (Tian, 2018). Feng and Cao (2018) argued that the shift from high speed to high quality reflected the concept of sustainability, while the transition from growth to

development reflected ecocentrism. Wang and Liu (2021) believed that the driving forces of innovation, coordination, greenness, openness, and shared principles could guide China's economic development towards high-quality growth. Zhou et al. (2022) constructed a four-tier indicator system for the high-quality development of China's economy based on four dimensions: the economic, social, environmental, and power systems.

Third, scholars had analysed the meaning of high-quality development from the perspectives of inputs, outputs, supply and demand. As early as the late 1970s, American economist James Tobin (1974) proposed measuring economic development using economic welfare scales. He assigned a positive value to leisure and unpaid employment in assessing economic development quality but did not account for environmental costs. Subsequently, American economists Herman and John (1992) developed a sustainable economic welfare index that deducted the costs of economic activities from economic benefits. Later, scholars like Barro (2002) and Tridico (2011) explored economic growth quality from various perspectives, such as the optimization of economic structure, stable growth, fairness, and resource environment.

Kamaev (1986) analysed economic development quality from the input-output perspective, using economic growth efficiency to represent growth quality. Devarajan (1996) borrowed from the Cobb-Douglas production function to analyse factors influencing economic growth, such as capital and labour inputs, in order to measure the quality of economic growth. Lin (2018) posited that the connotation of Quality lied in input-output efficiency, emphasizing that a key indicator of Quality was constant advancement in the

input-output efficiency of factors such as the environment, resources, land, capital, and labour. Xia et al. (2018) pointed out that the connotations of Quality included multiple dimensions, such as input-output, demand, and supply.

- Measurement Indicators for the Quality of Economic Development

There is currently no consensus on how to accurately measure a country's economic development quality. However, existing research methods for assessing economic development quality can be broadly categorized into the following approaches.

- ◆ Measurement Based on Input-Output Efficiency

Numerous studies suggested that improving economic efficiency was key to achieving high-quality development. Total Factor Productivity (TFP) and labour productivity were commonly used indicators of input-output efficiency. Many scholars used TFP as a measure of Quality. Generally, the stronger the contribution of TFP, the better the quality of economic development (Zheng, 2007).

For example, Chow and Li (2002) found that TFP contributed positively to China's economic development. Xiao (2014) incorporated natural resources and the environment as input factors into the Cobb-Douglas production function and combined this with green GDP to measure economic development quality using data from China between 2001 and 2011. Li et al. (2017) used China's TFP growth rate to measure economic development quality and explored whether the productive services sector could become a new motivating factor for

Quality in China. Their findings indicated that the high level of technological advancement in the productive services sector could enhance TFP, thereby promoting sustainable economic development.

In addition, Gao et al. (2019) argued that TFP is the fundamental driver of Quality. They analysed the sources of economic development in Shandong province by calculating TFP from 1978 to 2016. Liu et al. (2019) used TFP to measure economic development quality and explored the effects of national innovation-driven forces on Quality. Chen and Chen (2018) employed labour productivity from 286 prefecture-level cities in China from 2004 to 2013 to measure economic development quality, studying the influence mechanism of smog pollution on Quality. They discovered that alleviating smog pollution could effectively improve economic development quality.

◆ Measurement Based on Multi-dimensional Indicator Systems

Barro (2002) deeply explored economic growth quality from perspectives such as religion, politics, and society. Frolov et al. (2015) developed a regional economic growth quality evaluation system based on the human development index per capita and the average annual productivity growth rate, using matrix methods to calculate the corresponding economic growth quality. Ren et al. (2015) constructed an index system from six dimensions—the welfare distribution of economic growth, structure, stability, efficiency, the quality of the national economy, and the ecological environment—to measure the economic growth quality levels across various regions in China.

On the other hand, Shi and Ren (2018) developed Quality indicators with economic growth and social outcomes. Wei and Li (2018) constructed an index system to measure economic development quality levels from elements such as economic structure optimization, stable economic growth, improved market mechanisms, efficient resource allocation, innovation-driven development, and the benefits of economic outcomes to the people. Xiao (2019) assessed China's development quality in terms of economic growth and social development, finding that since 1978, China's development quality had undergone three phases: improvement, deterioration, and re-improvement.

◆ Measurement Based on Development Philosophy

Zhan and Cui (2016), using provincial data from 2000 to 2014, found that the Quality in most provinces had improved, with the Quality index in the eastern, central, western, and northeastern regions showing a fluctuating upward trend. Tong and Wang (2018) constructed an extensive index of Quality from the perspectives of scale, coordination, openness, and inclusiveness. Using data from key cities from 2005 to 2016, they studied the connections among smog pollution, environmental regulation, and Quality. The results showed that alleviating smog pollution was conducive to promoting economic development quality. Fang and Ma (2019) used an index system to measure the Quality in China in terms of innovation, coordination, greenness, openness, and shared development, using provincial panel data from 2012 to 2016. The results showed a yearly upward trend in Quality levels across the provinces. Gao et al. (2024) also used the five development concepts of innovation, coordination, greenness, openness, and sharing to measure Quality in China.

Table 2.3: Measurement of Economic Development Quality

Author (year)	Research methodology	Research content
Chow (2002)	Total Factor Productivity (TFP)	The value of the contribution of total factor productivity to China's economic growth is greater than 0.
Barro (2002)	Multi-dimensional indicator system	An in-depth exploration of the quality of economic growth from religious, political and social perspectives.
Chao and Ren (2011)	Multi-dimensional indicator system	Quality is measured from four perspectives: the structure of economic growth, stability, changes in welfare and distribution of results, resource use and ecological costs, using principal component analysis to determine the weights of each indicator.
Ren et al. (2015)	Multi-dimensional indicator system	Measuring the quality of China's economic growth in terms of six dimensions: welfare distribution, structure, stability, efficiency, as well as the quality of the national economy and the ecological environment.
Zhan and Cui (2016)	Multi-dimensional indicator system	Establishing an indicator system to measure the quality of economic growth from the development concept based on provincial data for 2000-2014.
Li et al. (2017)	Total Factor Productivity (TFP)	Higher levels of technological progress in productive services can raise total factor productivity, thereby promoting Quality and sustainable growth.
He and Shen (2018)	Total Factor Productivity (TFP)	Estimation of total factor productivity using the Solow residual method.
Chen and Chen (2018)	Total Factor Productivity (TFP)	Using the labour productivity of 286 prefectural and municipal cities in China from 2004 to 2013 to measure Quality and to study the mechanism of haze pollution's impact on Quality.
Wei and Li (2018)	Multi-dimensional indicator system	Measuring the level of Quality in terms of optimized economic structure, stable economic growth, improved market mechanisms, efficient resource allocation, innovation-driven development and economic outcomes for the benefit of the people.
Tong and Wang (2018)	Multi-dimensional indicator system	Determine the weights of indicators from four aspects: scale, coordination, openness and sharing, using factor analysis to construct a composite index of Quality.
Fang and Ma (2019)	Multi-dimensional indicator system	Based on China's province panel data from 2012 to 2016, measuring China's Quality in terms of the five development ideas of innovation, coordination, greenness, openness, and sharing.
Nie and Jian (2020)	Multi-dimensional indicator system	The vertical and horizontal slotting approach was used to assess Quality in 30 Chinese provinces in terms of product and service quality, economic benefits, social benefits, ecological benefits, and the level of economic functioning.

Table 2.3 continued

Author (year)	Research methodology	Research content
Gao et al. (2024)	Multi-dimensional indicator system	In accordance with the concept of high-quality economic development put forward by the Chinese Government, the tertiary indicators have been improved on the basis of the secondary indicators of innovation, coordination, greenness, openness and sharing that have already been constructed.

● Methods for Measuring Quality

The primary approach to assessing the level of Quality involved comprehensive evaluation methods, including techniques such as the Delphi method, the entropy method, the distance between superior and inferior solutions, and principal component analysis (PCA).

Table 2.4: Comparison of Methods for Measuring Quality

Evaluation methods	Specific names	Content Description	Advantages	Disadvantages
Qualitative evaluation method	Delphi method	Subjective judgement by experts	Easy operation	Highly subjective
Information theory method	Entropy method	Indicator weights based on the information of each indicator	Human interference, etc., can be excluded	Lack of horizontal comparisons between indicators
TOPSIS evaluation method	Problem-solving distance method	Ranking of a finite number of evaluation objects according to their proximity	No strict limitations on data distribution and sample size, number of indicators, less loss of information	Failure to address duplication of evaluation information due to correlation of evaluation indicators
Statistical analysis methods	Principal Component Analysis (PCA)	Simplification of indicators using dimensionality reduction techniques	Comprehensiveness, comparability, objectivity and reasonableness	The meaning of the function is not clear when the sign of the factor loading is both positive and negative

The expert scoring method assigned weights based on the preferences and knowledge of experts, making it highly subjective and lacking in scientific rigor and stability. The entropy method determined the weights of indicators based on their relative impact on the overall system, focusing on cross-sectional data at a single point in time and lacking horizontal comparisons between different indicators. The TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) ranked alternatives by comparing their relative distances to the best and worst scenarios. However, it relied on pre-assigned weights, which introduced a degree of subjectivity to the results. The entropy-weighted TOPSIS method integrated the entropy method with the TOPSIS approach, employing the entropy method to determine weights and the TOPSIS technique to rank indicators.

Principal component analysis (PCA) enabled the quantification of the contributions of various dimensions to the overall economic development quality, and the resulting weight structure could effectively reflect the importance of each dimension's basic indicators to the total index. Chao and Ren (2011) employed PCA to measure the quality of China's economic development, using dimensionality reduction to address multicollinearity issues among multiple indicators. Additionally, Wei et al. (2021) applied PCA to synthesize a comprehensive index when studying regional high-quality development levels, capturing multidimensional characteristics.

Although PCA effectively reduced redundant information and generated composite indicators, it had certain limitations. For example, PCA assumed linear relationships between variables, which might overlook nonlinear associations among the indicators.

Moreover, the interpretation of the principal components could sometimes be challenging. This study addressed the limitations of PCA in the following ways: (i) standardizing the data before constructing the composite index to minimize the impact of dimensional differences; (ii) conducting the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test to ensure the sample's suitability for PCA; and (iii) retaining only principal components with eigenvalues greater than 1, based on the factor loading matrix and the explained variance ratio, to ensure that the selected principal components sufficiently represent the original indicators.

Based on this, this study adopted PCA to determine the weights of the individual indices within each aspect index, synthesizing these aspect indices into a comprehensive index, and subsequently used the same method to construct a total index to quantify the state of China's economic development quality.

2.2.4 Theory of Tax Competition

- Tax Competition Effectiveness Theory

The theory of tax competition effectiveness was rooted in Tiebout's (1956) seminal work "A Pure Theory of Local Public Expenditure", which laid the foundation for various theoretical extensions, including those from the public choice school and the new economic geography school. Tiebout (1956) proposed the "voting with one's feet" model, where citizens, under assumptions such as perfect information, zero migration costs, absence of externalities in public services, and regional homogeneity, chose among different

government combinations of taxation and public services based on their preferences. Through sufficient competition, the optimal provision of public goods would be achieved. Fischel and White (1975) expanded the Tiebout model to include mobile firms, suggesting that through tax competition, firms chose jurisdictions, leading to efficient public goods provision and thus making tax competition effective. Richter and Wellisch (1996) further extended the model to incorporate mobile factors like capital and labour, arguing that tax competition could still achieve Pareto optimality in the provision of public goods under free factor mobility. Braid (1996), drawing on the theory of economies of scale, demonstrated that public goods provision benefited from these economies, thereby enhancing the effectiveness of tax competition.

The public choice school, represented by Buchanan, argued that tax competition could reduce rent-seeking behaviour and improve the efficiency of government spending. Buchanan et al. (1981) posited that politicians and bureaucrats aimed to maximize their own power (budget) rather than citizen welfare, leading to rent-seeking behaviour. Tax competition created an incentive to reduce such behaviour, thereby improving social welfare. Gordon and Wilson (1999) found that under conditions of citizen mobility, tax competition could reduce government waste and increase the efficiency of public funds, thus enhancing citizen welfare. The new economic geography school introduced the theory of agglomeration rent in response to the race-to-the-bottom theory. It posited that production factors could bear higher tax levels due to agglomeration economies, which might prevent them from moving to lower-tax areas, thus avoiding the race to the bottom.

- Tax Competition Ineffectiveness Theory

The theory of tax competition ineffectiveness argued that tax competition led to reduced total tax revenue, insufficient public goods provision, and the shifting of the tax burden to less mobile factors, resulting in tax distortions. Oates (1972) relaxed the assumption of no externalities in the Tiebout model, suggesting that under conditions of tax competition externalities, competition for capital would lead to the under-provision of public goods, harming public goods supply efficiency. Zodrow and Mieszkowski (1986), building on Oates's theory, developed the standard tax competition model, known as the Z-M model. The Z-M model assumed homogeneous jurisdictions, a fixed total supply of production factors, no externalities of public services across jurisdictions, and capital-only taxation. It argued that under these assumptions, governments would compete by lowering tax rates to attract more capital, leading to a race to the bottom, where tax rates became too low, resulting in insufficient public goods provision. Furthermore, as capital taxes were raised, capital would flow out, and the tax burden would eventually shift to immobile factors.

Bucovetsky and Wilson (1991) relaxed the assumption of regional homogeneity, discovering that smaller regions were more sensitive to tax rate changes and thus had a competitive advantage in tax competition. Mezzetti (1997), Osmundsen (1998), and Janeba (1998) each relaxed different assumptions of the Z-M model, completing the expansion of the standard tax competition model.

Based on the theory of tax competition ineffectiveness, a theory of tax coordination had also emerged. This theory suggested that unregulated tax competition was ineffective, and that competing entities could achieve win-win outcomes through cooperation, transforming tax competition from a non-cooperative game to a cooperative one, thereby maximizing overall benefits (Janeba, 1998; Mezzetti, 1997; Osmundsen, 1998). Morisset (2001) proposed that tax policies should be coordinated to mitigate the negative effects of tax competition. Oates (2001) argued that in the context of European Union's high integration but decentralized policy framework, tax competition might lead to an undersupply of public goods and overall efficiency losses. Therefore, supranational coordination mechanisms were necessary to correct market failures. Devereux et al. (2007) analysed the long-term dynamics and efficiency issues of horizontal tax competition within a game theory framework. They found that horizontal tax competition inevitably led to efficiency losses in static models. However, in dynamic repeated games, limited cooperation might be possible. Genschel and Schwarz (2011) suggested that tax coordination referred not only to similar tax rates and standardized tax administration but also to the coordination and communication among tax authorities.

2.3 Empirical Literature

This section included empirical studies on the respective relationships between VFI and Quality, Teffort, and Gstructure. It also discussed empirical studies on the relationship between Teffort and Quality, as well as that between Gstructure and Quality.

2.3.1 Relationship between VFI and Quality

In the context of deepening the reform of the fiscal system, the impact of VFI on Quality had become the focus of social attention. However, the existing literature on the subject was relatively small.

Several studies suggested that VFI might promote economic development quality by fostering healthy competition among local governments. For instance, Faguet (2004) found that VFI, by filling fiscal gaps through central government transfers, contributed to the improvement of Bolivia's economic development quality. Similarly, Chu et al. (2020) and Wang and Liu (2021) revealed that under a central regulatory framework, local governments might engage in institutional innovation (such as optimizing public services) to compete for policy advantages, thereby attracting talent and capital. However, the effectiveness of this mechanism heavily depended on the design of the official evaluation system. If the assessment emphasized short-term economic growth, VFI might instead lead to resource misallocation (Bao et al., 2017).

Under fiscal pressure, local governments might resort to large-scale borrowing to expand infrastructure, resulting in redundant construction and overcapacity, which exacerbated resource misallocation, reduced investment efficiency, and ultimately undermined economic development quality (Sun et al., 2019).

Moreover, by hindering market-oriented reforms and technological progress, VFI weakened environmental governance capacity and suppressed economic innovation and

green development, thereby impeding improvements in economic development quality (Wang et al., 2020; Liu et al., 2024). VFI also generated negative spatial spillover effects and exhibits significant heterogeneity across regions, with its impact varying notably according to regional characteristics (Song et al., 2021).

Finally, VFI not only directly hampered economic development quality but also indirectly did so by distorting local governments' public expenditure patterns. For example, it encouraged excessive infrastructure investment at the expense of public welfare spending, further restraining improvements in economic development quality (Wei et al., 2021). The above summary of the relationship between VFI and Quality was shown in Table 2.5.

Table 2.5: Overview of the Relationship between VFI and Quality

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Faguet (2004)	Bolivia	1987-1996	Principal Component Analysis (PCA) Fixed-Effects Model	VFI is beneficial to Quality through the use of central fiscal transfers to cover fiscal gaps
Bao et al. (2017)	China	2000-2006	Difference-in- Differences (DID)	Horizontal competition among local governments leads to over-reliance on investment for economic growth, which is not conducive to improving the quality of economic growth.
Sun et al. (2019)	China	1998-2015	System GMM	Inefficient allocation of resources due to duplication of construction and overcapacity caused by excessive spending by local governments, etc.
Chu et al. (2020)	China	2003-2016	Three-stage least squares(3SLS)	VFI drives long-term stable economic growth.
Wang et al. (2020)	China	2008-2018	Two-stage least squares(2SLS)	Fiscal imbalances inhibit the marketisation process by inhibiting technological progress, reducing consumer welfare and degrading environmental quality.

Table 2.5 continued

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Song et al. (2021)	China	2009-2017	OLS	Deepening VFI in the region can inhibit high-quality economic development.
Wei et al. (2021)	China	2007-2017	Three-stage least squares(3SLS)	VFI has negative indirect effects on Quality through public expenditure bias.
Wang and Liu (2021)	China	1995-2018	System GMM	VFI is conducive to balanced economic development.
Liu et al. (2024)	China	2007-2020	Two-way fixed-effects model	VFI has an N-shaped nonlinear effect on green development.

2.3.2 Relationship between VFI and Tax Effort

As an institutional outcome balancing local decentralization autonomy with the central government's need for concentrated management, the relationship between VFI and local government tax effort had sparked significant controversy. Existing research primarily explored the suppressive effect of VFI on tax effort, the dual effects of intergovernmental transfers, and the influence of regional heterogeneity and institutional environments.

First, most studies argued that VFI weakened local governments' tax effort through soft budget constraints and dependency on intergovernmental transfers. For instance, Von Hagen and Eichengreen (1996) highlighted that high VFI undermined local governments' tax and borrowing autonomy, making it difficult for them to effectively respond to economic or social shocks, thereby increasing the risk of fiscal crises characterized by insufficient public goods provision or debt default. This mechanism was particularly prominent in developing countries (Rodden, 2002).

Furthermore, when the central government implicitly guaranteed local fiscal stability through transfers, local governments tended to reduce their tax effort and expand risky expenditures, resulting in “moral hazard” (Eyraud & Lusinyan, 2013). Research on China supports this conclusion: Chu et al. (2019), using a panel simultaneous equations model, found that VFI significantly suppressed local tax effort at both the central and regional levels. Li et al. (2021) further pointed out that VFI indirectly reduced tax effort by diminishing local governments’ preference for livelihood expenditures. Yao et al. (2024) demonstrated that the deepening of VFI led local governments to lower their own tax efforts.

These conclusions, however, were highly dependent on the fiscal game structure between central and local governments. For example, although China’s 2002 income tax-sharing reform weakened local tax effort, local governments still sought to attract investment through low tax rates (Xie & Fan, 2015), suggesting that policy design could moderate the effects of VFI.

Second, as a core regulatory tool of VFI, intergovernmental transfers exhibited contradictory income and substitution effects. Barette et al. (2002), using German data, found that reduced transfers incentivized local governments to enhance their tax effort. However, if transfers were negatively correlated with local tax effort, they suppressed local tax incentives. Similarly, Fu and Shen (2012), comparing developed and underdeveloped regions in China, observed that although transfers increase per capita fiscal revenue in underdeveloped regions, they generated negative incentives for tax effort.

This contradiction became more complex in the context of regional heterogeneity. Zhao et al. (2021) revealed that VFI indirectly exacerbated capital misallocation by weakening tax effort, though developed regions might mitigate this effect by optimizing their business environments.

Third, VFI might indirectly promote economic development by suppressing tax effort. Chu and Fei (2021) found that VFI reduced local tax effort, alleviating the tax burden on enterprises, which in turn stimulated investment and economic growth. This conclusion appeared contradictory to the “tax effort suppression theory” but actually reflected the multifaceted effects of VFI: if reduced tax effort enhanced market vitality, short-term economic growth might obscure long-term fiscal risks (Jia & Ying, 2016). The above summary of the relationship between VFI and Teffort was shown in Table 2.6.

Table 2.6: Overview of the Relationship between VFI and Teffort

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Von and Eichengreen (1996)	Countries in the European Monetary Union	1990-1995	Theoretical analyses and comparative studies	Excessive levels of VFI leave local governments without sufficient tax and borrowing power to respond to economic or social shocks.
Rodden (2002)	43 countries	1986-1996	Three-stage least squares (3SLS)	Local governments are more prone to incur budget deficits when they rely on transfers from the federal government.
Baretti et al. (2002)	Germany	1970-1998	Generalized Moment Models (GMM)	Lower tax efforts by local governments can exacerbate VFI.
Fu and Shen (2012)	China	1980-2008	Generalized Moment Models (GMM)	VFI inhibits local government tax efforts.

Table 2.6 continued

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Eyraud and Lusinyuan (2013)	OECD countries	1995-2007	Least Squares Dummy Variable Method	Moderate imbalances help restrain local government taxation behaviour.
Xie and Fan (2015)	China	2002-2007	Generalized Moment Models (GMM)	The income tax sharing reform of 2002 weakens local government tax efforts.
Jia and Ying (2016)	China	2000-2008	Two-stage least squares (2SLS)	VFI can prompt local governments to pass on the cost of their expenditures through the public pool channel, leading to a decline in the effective average tax rate for firms and dampening local governments' tax collection efforts.
Chu et al. (2019)	China	2002-2016	Three-stage least squares (3SLS)	VFI shows a significant dampening effect on tax effort.
Zhao et al. (2021)	China	2002-2017	Three-stage least squares (3SLS)	VFI has indirect effects on capital mismatches through local government tax efforts.
Li et al. (2021)	China	2007-2018	Three-stage least squares (3SLS)	Increased VFI are not conducive to increased local government spending on livelihoods and can dampen local tax collection efforts.
Chu and Fei (2021)	China	1998-2017	Three-stage least squares (3SLS)	VFI can indirectly contribute to economic growth by dampening the level of tax effort by local governments.
Yao et al. (2024)	China	2013-2022	Three-stage least squares (3SLS)	The deepening of VFI leads local governments to reduce their own tax efforts.

2.3.3 Relationship between Tax Effort and Quality

Regarding local government Teffort and its impact on economic growth, most scholars tended to explore this issue from the perspective of tax competition. However, the existing conclusions were again divided. The first view was that interregional tax

competition could have positive effects by attracting capital inflows, promoting economic growth, or improving residents' welfare (Becker & Rauscher, 2013; Brülhart & Jametti, 2019). The second view acknowledged that while tax competition might help local governments attract investment and achieve economic growth, excessive relaxation of tax effort could pose challenges to fiscal sustainability (Miyazawa et al., 2019). Existing studies focus on the promotion effects of tax competition, the inhibitory effects of tax competition, and the nonlinear impact of tax effort on Quality, with significantly divergent conclusions.

First, some scholars argued that local governments could stimulate short-term economic growth by reducing tax effort to attract capital inflows. For example, Guo and Li (2009), using a spatial econometric model, found that Chinese provinces exhibited spatial strategic complementarity in tax policies, particularly for value-added tax and corporate income tax. Their findings indicated that low-tax policies in neighbouring regions triggered local imitation, creating an investment agglomeration effect. Lu and Wu (2019) further pointed out that China's local tax competition had not resulted in a "race to the bottom". Instead, through differentiated strategies, such as optimizing the business environment, local governments had promoted regional economic growth.

Second, excessive tax competition undermined fiscal sustainability and distorts resource allocation. Shen and Fu (2006), using a spatial lag model, demonstrated that tax competition among Chinese provincial governments led to resource misallocation and macroeconomic volatility, significantly inhibiting long-term growth. Shangguan and Ge (2019) found that a "race-to-the-bottom" tax competition among local governments

weakened the effectiveness of environmental governance policies and exacerbated smog pollution, suggesting that low tax effort might come at the expense of public service quality.

Finally, while most studies focused on economic growth, a few had begun to explore the relationship between tax effort and Quality. Chu et al. (2020), using a panel threshold model, found an inverted U-shaped relationship between tax effort and Quality: when tax effort was below a certain threshold (1.4516), its increase helped optimize resource allocation; however, beyond this threshold, excessive corporate tax burdens instead suppressed innovation vitality, leading to a decline in Quality. Chu and Fei (2021) further pointed out that tax effort inhibited local economic development through a “fiscal extraction effect”. This effect was particularly pronounced in regions with a single-industry structure, where high tax effort exacerbated the risk of business outflow. Tian and Wang (2023) revealed that local government tax effort in the Yangtze River Delta significantly suppressed regional high-quality economic development. The above summary of the relationship between Teffort and Quality was shown in Table 2.7.

Table 2.7: Overview of the Relationship between Teffort and Quality

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Shen and Fu (2006)	China	1994-2003	Spatial Lag Model (SLM)	Excessive tax competition will have a negative impact on the efficiency of regional resource allocation and will cause macroeconomic volatility.
Guo and Li (2009)	China	1999-2005	Spatial Durbin Model	Teffort has a positive effect on economic growth.

Table 2.7 continued

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Shangguan and Ge (2019)	China	2007-2016	Spatial Durbin Model	Bottom-up tax competition among local governments reduces the hazard-reduction effectiveness of environmental governance policies.
Lu and Wu (2019)	China	2000-2014	Threshold Panel Model	Local tax competition promotes economic growth in our region.
Chu et al. (2020)	China	2003-2016	Threshold Panel Model	The degree of local government tax effort has a considerable non-linear negative effect on Quality.
Chu and Fei (2021)	China	1998-2017	Three-stage least squares (3SLS)	Increased taxation by local governments has a negative impact on local economic growth.
Tian and Wang (2023)	China	2008-2020	Three-stage least squares (3SLS)	Local government tax efforts in the Yangtze River Delta have a significant dampening effect on the high-quality development of the regional economy.

2.3.4 Relationship between VFI and Expenditure Structure

Fiscal decentralization theory suggested that local governments had an informational advantage in public expenditure decisions, which could enhance social welfare. However, in practice, the decentralization of fiscal revenue often lagged behind expenditure decentralization, resulting in VFI. This imbalance profoundly impacted the structure of regional public expenditures. Existing literature on the relationship between VFI and Gstructure could be summarized into two main pathways.

- Theoretical Explanations of Fiscal Decentralization Incentives and Expenditure Bias

Local governments' public spending behaviour in China was shaped by both fiscal decentralization and the political promotion tournament mechanism. Fu and Zhang (2007), using provincial panel data from 1994 to 2004, found fiscal decentralization positively correlated with economic construction expenditures but negatively associated with spending on education, science, culture, and health. This indicated that under fiscal decentralization, local governments tended to reduce public service expenditures in pursuit of economic growth. Huang (2013), based on empirical research on the eastern, central, and western regions from 1998 to 2010, further revealed that decentralization reforms intensified local officials' pursuit of "visible achievements", leading to a stronger preference for infrastructure over welfare expenditures.

Zhang (2013) demonstrated that the impact of revenue decentralization on productive expenditures exhibited an inverted U-shaped nonlinear pattern: when revenue decentralization was below a particular threshold, increased decentralization strengthened the bias towards productive spending; however, expanding expenditure decentralization lowered this threshold. Jia and Ning (2015) argued that while revenue decentralization promoted social welfare spending by enhancing local fiscal autonomy, expenditure decentralization drove investment in infrastructure projects, such as transportation. Jiang (2009), using fiscal data from 1994 to 2005 at the provincial, municipal, and county levels, found that the combination of economic decentralization, political centralization, and term limits for officials exacerbated VFI, distorting expenditure structures. Li and Li (2024)

further argued that decentralizing fiscal authority expanded local governments' self-interest, resulting in expenditure bias towards non-livelihood-related projects.

- VFI's Impact Pathways and Effects on Gstructure

VFI forced local governments to fill fiscal gaps through reliance on intergovernmental transfers, land finance, and debt financing, leading to expenditure bias. Bardhan and Mookherjee (2006) pointed out that in developing countries, the mismatch between revenue and expenditure decentralization trapped local governments in a “fiscal-administrative imbalance”, causing public spending to deviate from residents' needs. Fu and Shen (2012), using provincial data from 1995 to 2006, found that intergovernmental transfers not only generated a “flypaper effect” but also distorted the expenditure structure, weakening the goal of equalizing basic public services. Jia et al. (2014), based on GMM estimates using county-level data, revealed that regions with high VFI exhibited stronger expenditure decentralization effects, with county governments demonstrating a more pronounced bias towards infrastructure spending. This effect was particularly evident in underdeveloped areas with net fiscal inflows (Jia et al., 2016).

Zhao and Li (2016), using provincial panel data from 1996 to 2012, confirmed a threshold effect of VFI on the efficiency of education and public health expenditures: once VFI surpassed a critical level, its suppressive impact on social spending efficiency became significantly stronger. Similarly, Wang (2016) found that reducing expenditure decentralization and alleviating VFI effectively curbed local government debt expansion, a

conclusion supported by data from 26 provinces from 1998 to 2014. Liu and Zhang (2022), using 1998–2018 provincial data, revealed that VFI indirectly suppressed government spending on science and technology through the mediating effect of transfer payments. Feng et al. (2023) further demonstrated that VFI reduced energy efficiency by crowding out government technological expenditures, highlighting how expenditure bias constrained high-quality development.

Overall, the existing literature generally agreed that VFI significantly influenced Gstructure, resulting in a bias towards infrastructure and economic construction spending, while underfunding livelihood and technological expenditures. Additionally, transfer payments often exhibited a “flypaper effect” in local expenditure behaviour, further distorting expenditure structures. The above summary of the relationship between VFI and Gstructure was shown in Table 2.8.

Table 2.8: Overview of the Relationship between VFI and Gstructure

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Bardhan and Mookherjee (2006)	20 developing countries	1970-1992	Nonlinear Pricing Model	VFI leads to deviations in Gstructure of local governments.
Fu and Zhang (2007)	China	1994-2004	Ordinary Least Square (OLS)	Chinese-style fiscal decentralization contributes to distortions in the public expenditure structure of local governments.
Jiang (2009)	China	1994-2005	Hunter Method	Excessive VFI can lead to distortions in the public expenditure structure of local governments.
Fu and Shen (2012)	China	1995-2006	System GMM	By altering the existing fiscal expenditure structure, the current transfer system deviates from the goal of equalization of essential public services.

Table 2.8 continued

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Huang (2013)	China	1998-2010	Seemingly Unrelated Regression (SUR)	Chinese-style fiscal decentralization has led to a preference for regional capital construction in public expenditure choices, with a marked lack of attention to welfare and security spending in the jurisdictions.
Zhang (2013)	China	2000-2010	System GMM	The effect of decentralization of fiscal revenue on the percentage of productive expenditure is characterized by an inverted U-shaped non-linear change in the share of productive expenditure.
Jia et al. (2014)	China	1997-2006	GMM	VFI has exacerbated the bias in Gstructure of county governments towards capital expenditures.
Jia and Ning (2015)	China	1998-2007	DID Method	Revenue decentralization has had a positive effect on the level of local government spending on people's livelihoods and welfare.
Jia et al. (2016)	China	2001-2007	System GMM	Misalignment of financial and administrative powers exacerbates local governments' land finance behaviour in underdeveloped areas.
Zhao and Li (2016)	China	1997-2013	Panel threshold regression model	VFI harms the efficiency of social spending.
Wang (2016)	China	1998-2014	System GMM	Increasing revenue decentralization, reducing expenditure decentralization and mitigating VFI will help to reduce local debt.
Liu and Zhang (2022)	China	1998-2008	Mediation effects model	The negative impact of VFI on government spending on science and technology depends on intergovernmental fiscal transfers.
Feng et al. (2023)	China	2001-2017	System GMM	VFI can inhibit improvements in energy efficiency by reducing government spending on science and technology.
Li and Li (2024)	China	2005-2020	Panel threshold regression model	Fiscal decentralization has expanded the degree of self-interest of local governments, leading to an expenditure structure that favours non-livelihood expenditures.

2.3.5 Relationship between Expenditure Structure and Quality

Scholars had conducted extensive research on the relationship between Gstructure and economic growth. Although the findings were mixed, the general consensus was that the former had a significant impact on the latter. Barro (1990), using panel data from 85 countries between 1960 and 1985, argued that productive public expenditures could compensate for insufficient private investment, thereby promoting long-term economic growth. In contrast, consumptive public expenditures, while improving social welfare, might suppress the economic growth rate. Easterly and Rebelo (1993), through cross-country panel data analysis, found that the structure of fiscal policy was closely linked to the level of development and was influenced by the scale of the economy. In developing countries, government spending on transportation and communication was highly correlated with economic growth.

Devarajan et al. (1996), based on a study of 43 developing countries, highlighted a significant negative correlation between capital expenditures and economic growth. Kelly (1997), using panel data from 73 countries between 1970 and 1990 and applying the system generalized method of moments (GMM), found a nonlinear relationship between public expenditures and economic growth. Her study revealed that productive expenditures (such as infrastructure, education, and healthcare) had a significant positive impact on economic growth, whereas non-productive expenditures (such as social security and defence) had a negative effect. Tulsidharan (2006), based on data from India between 1970 and 2005,

showed that government spending positively affected economic growth, although the marginal effect diminished as spending increases.

Compared to studies on the relationship between Gstructure and economic growth, research on the link between Gstructure and Quality was relatively scarce. Nevertheless, the existing literature indicated a nonlinear relationship between the two. Odawara (2011), using the autoregressive distributed lag (ARDL) model, analysed quarterly data from five OECD countries from 1970 to 2008, as well as data from Latin America, East Asia, and Europe from 1970 to 2006. Their findings suggested that government investment expenditures positively influenced Quality, but this effect was subject to a threshold—beyond a certain level, the positive effect weakened or even disappears. Meričková et al. (2017), applying data envelopment analysis (DEA) to data from 27 EU countries, along with Norway and Switzerland, from 2010 to 2013, explored the relationship between Gstructure and the Human Development Index (HDI). They found that the total amount of public spending did not significantly affect socioeconomic development, whereas public service expenditures on education, healthcare, and social services positively contributed to socioeconomic progress. Amusa and Oyinlola (2019), using the ARDL bounds testing approach, analysed data from Botswana between 1985 and 2016. Their study revealed a long-term positive relationship between Gstructure and Quality, although in the short term, Gstructure exerted a negative impact on Quality.

In China, scholars generally agreed that local government expenditure behaviour was closely linked to regional economic development quality, with different effects in the short

and long term. First, China's decentralization system had played a positive role in promoting marketization and encouraging local governments to compete for development. However, it had also distorted Gstructure, resulting in insufficient investment in human capital and public services. Fu and Zhang (2007) argued that under China's decentralized system, local governments faced performance assessments driven by GDP growth, which compelled them to prioritize tournament-style competition. As a result, local governments heavily invested in large-scale infrastructure to achieve short-term economic growth while neglecting human capital and public services. Second, as local governments gained increasing authority over the allocation of public resources, their spending behaviour became biased towards administrative cost expansion and infrastructure investment, significantly influencing regional economic development. Gong and Lu (2009) pointed out that local governments' fiscal expenditures were tilted towards infrastructure investment, resulting in insufficient public service provision and ultimately hindering improvements in economic development quality.

The existing literature demonstrates that Gstructure not only affected economic growth but also played a critical role in shaping economic development quality. However, research findings varied, and the relationship exhibited nonlinear characteristics across different countries and regions. Overall, productive public expenditures (such as education, healthcare, and infrastructure) generally enhanced economic development quality, while excessive capital expenditures or non-productive spending might hinder Quality improvement. Moreover, under China's decentralized system, local governments'

expenditure behaviour was characterized by tournament competition, which led to insufficient public service investment, thereby constraining improvements in regional economic development quality. The above relationship between Gstructure and economic growth was summarised in Table 2.9.

Table 2.9: The Relationship between Gstructure and Economic Growth

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Barro (1990)	85 countries	1960-1985	Ordinary Least Squares (OLS)	The nature and size of government spending have an impact on economic growth, and there is a negative link between government spending and economic growth.
Easterly and Rebelo (1993)	28 developing countries	1970-1988	Ordinary Least Squares (OLS)	Transport and communication expenditures in productive government expenditures in developing countries are closely related to economic growth.
Devarajan et al. (1996)	43 developing countries	1970-1989	Ordinary Least Squares (OLS)	Capital expenditure is significantly negatively correlated with economic growth.
Kelly (1997)	73 countries	1970-1990	Ordinary Least Squares (OLS)	Productive public expenditures, such as infrastructure, education, and health, boost economic growth.
Tulsidharan (2006)	India	1970-2005	Ordinary Least Squares (OLS)	Government spending in India has a positive impact on economic growth, but this impact diminishes as spending increases.
Fu and Zhang (2007)	China	1994-2006	Two-stage least squares (2SLS)	The higher the fiscal decentralization, the more likely local governments are to raise capital expenditures.
Gong and Lu (2009)	China	1999-2005	Multi-option Logit Models	The degree of fiscal decentralization is positively correlated with the indexes of under-provision of education expenditures and pension and social welfare benefits.
Odawara (2011)	5 OECD countries and countries in East Asia and Europe	1970-2006	Autoregressiv e Distributed Lag Model (ADLM)	The impact of government consumption expenditures on economic growth is less pronounced, with infrastructure and social expenditures favourable to economic growth in both the long and short run.

Table 2.9 continued

Author(s) (year)	Study Population	Timespan	Research Methodology	Findings
Merickova et al. (2017)	European Union 27	2010-2013	Data Envelopment Analysis (DEA)	Public services such as education, health, and social services had a positive impact on socioeconomic development.
Amusa and Oyinlola (2019)	Botswana	1985-2016	Autoregressive Distributed Lag Model (ADLM)	There is a positive relationship between government expenditure and economic growth in Botswana in the long run, but in the short run, government expenditure hurts economic growth.
Liu et al. (2023)	China	1996-2019	Bayesian Model Averaging (BMA)	Government investment in science and technology can contribute to more sustainable economic growth in the long run due to positive spillover effects on firms' R&D activities and the application of innovations

2.4 Research Gaps

Existing studies have provided a relatively solid theoretical foundation for the current investigation of VFI and its economic and social effects, but there are also some limitations.

Previous studies on the impact of VFI on Quality have typically focused on a single pathway, either through local governments' Teffort (Jia & Ying, 2016; Chu et al., 2019; Chu & Fei, 2021) or Gstructure (Fu & Shen, 2012; Jia et al. 2016; Amusa & Oyinlola, 2019; Liu & Zhang, 2022; Feng et al., 2023). However, no research has placed both revenue and expenditure within a unified framework to comprehensively examine the total effect of VFI on Quality following the dual pathway.

Since its outbreak at the end of 2019, the Covid-19 pandemic has had profound effects on the global economy. Nevertheless, there is a noticeable gap in the literature

regarding the impact of Covid-19, as an exogenous shock variable, on Quality in China, especially under the dual path of Teffort and Gstructure. This study aims to fill this gap by investigating the effects of the pandemic on China's Quality.

2.5 Hypothesis Development

Since the implementation of the tax-sharing reform, China has gradually established a decentralized system characterized by the centralization of fiscal powers and the decentralization of responsibilities. In this system, the imbalance between the revenue and expenditure obligations of national and local governments has led to inconsistent decision-making between them, resulting in VFI with profound implications for Quality.

The impact of local government fiscal behaviour on Quality is primarily reflected in two paths: the revenue path and the expenditure path. According to fiscal decentralization theory, VFI leads to disparities in local tax revenue, directly affecting the capacity of regional fiscal expenditure, and consequently in the level of public goods provision by local governments, which ultimately causes regional economic development disparities. Based on tax competition theory, to alleviate VFI and stand out in interregional competition, local governments strive to enhance their fiscal expenditure efficiency to promote Quality. At the same time, they tend to allocate fiscal revenue primarily to economic construction to improve the local investment environment and attract resource inflows. Therefore, this study will analyse the impact of VFI on Quality through the lenses of Teffort and Gstructure.

2.5.1 Hypotheses for VFI, Tax Effort and Quality

- **Hypotheses for Vertical Fiscal Imbalance and Quality of Economic Development**

Theoretically, moderate VFI can enhance the central government's ability to control local fiscal powers, promoting the achievement of macroeconomic policy goals and healthy national economic growth (De Mello, 2000; Persson & Tabellini, 1996). Moreover, the central government can also use the cost-compensation mechanism of transfer payments to comprehensively improve local government performance (Faguet, 2004).

On the one hand, moderate VFI strengthens the central government's macroeconomic power, regulates local fiscal behaviour through the transfer payment system, facilitates the rational flow of capital across the country, alleviates factor market distortions, improves the living standards of residents in underdeveloped regions, and boosts balanced economic development (Chen et al., 2017). Moreover, competition among local governments under the VFI system also promotes regional coordinated development through the demonstration and learning effects, stimulates institutional innovation by local authorities, and enhances the quality of government service provision and economic development.

On the other hand, however, the tax-sharing reform led the central government to decentralize administrative powers and expenditure responsibilities while centralizing fiscal powers, creating a state of fiscal imbalance. This mismatch between local fiscal powers and expenditure responsibilities has imposed significant fiscal pressure on local governments

(Lin & Sun, 2019). Consequently, local governments engage in protectionism and competition to secure limited resources. If intergovernmental competition manifests via mechanisms like market division, redundant development, and financial expenditure distortions, it will suppress technological creativity and productivity gains, leading to factor market misallocation and distortions. Additionally, due to the central government's policy of fiscal support, the aggravation of VFI will cause regional authorities to become overly reliant on transfer payments, pushing them into an "incentive trap" characterized by reduced tax effort and relaxed budgetary constraints (Chu et al., 2019). This will likely lead local authorities to reduce government service expenditures in favour of economic expenditures, thereby suppressing regional livelihood economies and high-quality development.

H1: The current level of vertical fiscal imbalance hinders China's quality of economic development.

- Hypotheses for Tax Effort and Quality of Economic Development

First, a low level of Tax effort significantly undermines the quality of economic growth. When local governments relax their Tax effort, it can result in regional resource misallocation and intensify horizontal disparities. This leniency often increases reliance on land finance and local government debt, ultimately obstructing improvements in local Quality. The use of tax incentives to attract investment may lead to the rapid expansion and concentration of a limited number of government-supported industries. This, in turn, exacerbates imbalances in the local industrial structure and contributes to overcapacity issues. Furthermore, the

decline in self-generated revenue due to reduced tax effort is frequently offset by land sales or debt financing. While this may temporarily fuel real estate development, it also drives up the costs of government fund management and debt repayment, ultimately weakening macroeconomic sustainability and reducing economic growth quality. Moreover, regions with stronger economic development are already more attractive to capital inflows. Thus, the use of tax incentives in interregional competition may offer limited benefits, potentially resulting in the outflow of fiscal resources from weaker regions and inefficient cross-regional investment allocation, further impeding the long-term quality of local economic development (Shen & Fu, 2006).

Second, while a gradual increase in Tax effort can support economic growth, excessive tax effort may erode the tax base, thereby constraining improvements in regional Quality. China's vast territory and the disparities in natural resource endowments and policy orientations across regions have led to divergent industrial development trajectories. The varying economic growth effects of different industries make it challenging to achieve regionally convergent economic development. In contrast to economically advanced regions with abundant tax resources, less-developed regions with weaker revenue-generating capacities must often intensify their tax effort to meet the revenue targets imposed by higher-level governments (Lv & Guo, 2011). However, the substantial tax burden stemming from excessive tax effort can quickly dampen the production incentives of microeconomic entities, prompting many enterprises to relocate and causing tax base erosion. Consequently, the fiscal revenue losses from the shrinking tax base may surpass the gains from the increased

tax effort. This not only weakens the governance capacity of local authorities but also hampers the enhancement of regional economic growth quality.

H2: Local government tax effort has a suppressive impact on quality of economic development.

- Hypotheses for Vertical Fiscal Imbalance and Tax Effort

Under the VFI system, local governments face considerable fiscal pressure and promotion-driven incentives, which may lead to a sustained decline in Teffort. The fiscal strain stemming from the asymmetry between revenue and expenditure decentralization compels local governments to increasingly rely on land finance and debt revenue. Although this strategy offers a short-term solution to local fiscal challenges, it also results in a relaxation of tax collection efforts. Moreover, China's top-down official performance evaluation system, which has historically prioritized GDP growth as the primary metric, fosters a competitive environment where local governments engage in economic rivalries and political promotion contests. This GDP-centric framework encourages local governments to prioritize short-term economic expansion over sound fiscal practices.

Given the scarcity of marketable assets and the profit-driven nature of capital, local governments frequently engage in competition or bargaining. In their efforts to attract capital inflows, establish businesses, and secure scarce funding, they often resort to tax incentives. However, this practice further weakens their Teffort.

Consequently, prolonged VFI distorts local governments' Teffort. The severe mismatch between local government revenues and expenditures not only increases dependence on central transfer payments and promotes soft budget constraints but also erodes fiscal discipline. This makes local governments more prone to making risky decisions or adopting excessive expenditure plans, thereby disrupting the internal balance between local fiscal revenues and expenditures. Even if local governments receive greater taxation autonomy, they may still strategically reduce their tax effort to maximize central transfer payments or exploit the common pool effect, shifting expenditure costs to higher levels of government.

When the transparency and standardization of the transfer payment system are inadequate, higher levels of VFI further suppress regional governments' Teffort (Bird & Tarasov, 2004; Fisher, 1982; Jia & Ying, 2016; Oates, 1993; Rodden et al., 2003; Turati et al., 2012). For instance, Barette et al. (2002) conceptualize transfer payments as a "tax on tax" revenue, whereby an increase in local Teffort results in a reduction of transfer payments, effectively functioning as a tax on local government revenue. They argue that this dynamic, driven by the revenue and substitution effects of transfer payments, tends to diminish local governments' Teffort. When local governments reduce their Teffort, in turn, it not only lowers their own revenue but also exacerbates the degree of VFI.

H3: Vertical fiscal imbalance inhibits the tax effort of local governments.

- Hypotheses for Vertical Fiscal Imbalance and Tax Effort on Quality of Economic Development

First, the impact of Teffort on Quality exhibits nonlinear changes in relation to the level of VFI. At a moderate imbalance level, the pressure of fiscal gaps incentivizes local governments to increase their tax effort, thereby fully leveraging the positive effects of tax revenue collection on fiscal revenue and economic regulation and promoting the advancement of Quality. Under China's decentralized system, the dual incentive and constraint mechanisms of local residents "voting with their feet" and GDP-centred economic competition compel local governments to optimize public service provision and vigorously develop the local economy, thereby improving human capital and supporting local economic growth through yardstick competition and racing to the top. As the local economy develops rapidly, Gao (2006) argued, local governments can fully exploit the tax administration space between theoretical tax amounts and actual tax revenues, increasing local fiscal revenue by improving tax effort to meet the diverse demands of local residents for government service provision.

Second, when VFI reaches excessively high levels, the capacity of local governments to enhance their Teffort becomes constrained. Under such conditions, intergovernmental competition increasingly revolves around low-tax policies, which indirectly affects economic development by weakening public service provision and reducing employment-driven consumption. A decline in Teffort directly results in short-term fiscal revenue losses, which in turn hinders local infrastructure development and the delivery of public services.

Consequently, the adoption of a long-term, low-tax competition strategy significantly undermines fiscal sustainability and impedes the advancement of Quality.

H4: Vertical fiscal imbalance indirectly affects the quality of economic development through the tax effort of local governments .

2.5.2 Hypotheses for VFI, Expenditure Structure and Quality

- **Hypotheses for Vertical Fiscal Imbalance and Expenditure Structure**

First, under China's fiscal decentralization system, the widening fiscal revenue-expenditure gap due to increasing VFI makes it optimal for regional authorities to focus on economic projects that expand the tax base and enhance Teffort to ensure regional activities function normally (Oates, 1993). Consequently, local governments prioritize investment in regional enterprises and production projects, thereby reducing the availability of government goods and ignoring the residents' desire for these goods. This results in a distorted public expenditure structure, characterized by a marked emphasis on investment over public welfare.

Second, the exacerbation of VFI tends to increase local governments' excessive dependence on central transfers, resulting in a decrease in the proportion of public expenditures. Within China's fiscal transfer payment system, the growing VFI compels local governments to depend on transfer funds and non-tax revenues to fill fiscal gaps, with central transfer payments often providing a faster and more effective remedy. Moreover, the limited

ability of local governments to develop tax sources to increase fiscal revenues leads to a reliance on central transfer funds, which often serve as local public expenditure projects (Fisher, 1982). This reliance on central transfers further worsens local fiscal deficits, while the flypaper effect simultaneously weakens the incentive effect of transfer payments on public expenditure.

Third, scale competition between regions further distorts Gstructure. Due to regional differences in resource allocation, governments in less developed areas must exert greater fiscal effort, such as increasing tax rates or expanding the tax base, to match the public expenditure levels of more developed regions. However, the increased tax burden exacerbates the outflow of resources from these regions. To avoid the loss of tax sources and benefit from horizontal competition, less developed local governments inevitably increase their dependence on central transfers, which in turn exacerbates vertical fiscal imbalance and ultimately leads to a deviation from the optimal public expenditure structure. This typically manifests as excessive public investment and insufficient public service expenditures (Keen & Marchand, 1997). Additionally, under the top-down administrative evaluation mechanism, local government officials driven by the pursuit of career advancement engage in economic tournaments, which creates another layer of scale competition among local governments. To gain a favourable position in these economic tournaments, local governments tend to focus on economic development projects that boost GDP and tax revenues, leading to skewed public expenditure behaviour that further exacerbates the existing bias in Gstructure.

H5: Vertical fiscal imbalance inhibits local governments' expenditure structure.

- Hypotheses for Expenditure Structure and Quality of Economic Development

An increase in the proportion of livelihood-related expenditures by local governments can continuously enhance Quality. First, as the nation's economy transitions to a new era of high-quality development and the individual's desire to seek a better life grows, the central government gradually incorporates welfare projects into the performance assessment system for regional government officials. Local governments will proactively adapt to this policy shift, aiming to improve people's quality of life by optimizing Gstructure, focusing on sectors such as education, healthcare, and employment. This approach enhances the region's soft environment, making it more attractive to capital and high-quality talent and thereby driving long-term improvements in Quality.

Second, although local governments in China have limited revenue authority under the fiscal decentralization system, they have greater autonomy over expenditures. Local governments can leverage their information advantages to identify local resource endowments and the most pressing needs of residents, allowing them to precisely optimize the public expenditure structure. This not only improves resource allocation efficiency (Qian & Weingast, 1997) but also enhances the quality of local economic development in the long run.

Third, under the long-term incentives of the political promotion tournament, the GDP-first performance evaluation system for officials has led to a rapid increase in production-oriented expenditures by local governments, resulting in diminishing marginal

returns on such expenditures. In the context of a new era of economic development, the marginal returns from increased livelihood-related expenditures by local governments will significantly exceed those from production-oriented expenditures. Therefore, optimizing the public expenditure structure not only helps meet the people's growing desire for a better life and assists local officials succeed in the political promotion tournament but also mitigates the negative effects of the previous rapid growth in production-oriented expenditures, thereby significantly enhancing Quality in the jurisdiction.

H6: Local governments' expenditure structure promotes the quality of economic development .

- Hypotheses for Vertical Fiscal Imbalance and Expenditure Structure on Quality of Economic Development

Under moderate VFI, fiscal resources and expenditure responsibilities between the central and local governments are more balanced, allowing for the optimization of Gstructure, which in turn positively impacts Quality. First, more rational resource allocation helps improve government spending efficiency and avoids redundant construction and resource waste. Second, enhanced fiscal autonomy among local governments enables precise investment based on actual local needs, improving the quality and efficiency of public service delivery, especially in livelihood areas such as education and healthcare. Third, balanced fiscal resource allocation supports coordinated infrastructure investment, preventing blind construction and promoting the distinctive development of local economies.

Additionally, fiscal balance allows local governments to have more monetary incentives to support industrial upgrading and technological innovation, fostering the development of high-value-added industries. More importantly, with sufficient fiscal resources, local governments can decrease their dependency on land finance and debt financing, thereby lowering fiscal risks and maintaining economic stability. Finally, improved fiscal transparency and governance levels also help reduce corruption and waste, further enhancing the quality of government services and social welfare.

However, if local governments fall into excessive VFI, the pursuit of economic growth performance becomes the sole development orientation, leading to an inevitable expansion of expenditure scale and a bias towards economic construction expenditures, which significantly hinders the improvement of Quality. Thus, VFI continuously strengthens the influence of expenditure behaviour adjustments on economic growth quality in the following three ways. First, to alleviate their fiscal pressure under the asymmetric decentralization system while also maximizing their chances for promotion, local government officials will increasingly distort their expenditure behaviour, thereby affecting Quality. Second, under the high-competitive pressure of VFI, local governments will shift towards industries with short cycles and high returns, exacerbating the negative effects of rising expenditure scales and structural imbalances on Quality. Third, in the race to catch up with more developed provinces and cities, local governments with different levels of economic development may blindly imitate their competitors' expenditure behaviour

without considering their actual economic conditions, thereby indirectly affecting Quality through adjustments in local government expenditure structure and scale.

H7: Vertical fiscal imbalance indirectly affects the quality of economic development through expenditure structure of local governments.

2.6 Summary of the Chapter

The above literature review represents the current state of and recent progress in the research on vertical fiscal imbalance and economic development quality. The substantial achievements of previous scholars provide the foundation for this study, while the differences and limitations in existing literature also guide the directions for further research in this study.

In the literature on VFI, scholars have explained its causes and connotations in terms of effective governance, bodily authority, and dynamic adjustment, which lays a theoretical foundation for explaining the level of China's vertical fiscal imbalances in Chapter Four.

In the literature on Quality, scholars have analysed the connotations of Quality from the perspectives of economics, new development concepts, and input-output, which lay the theoretical foundation for analysing the Quality of China in Chapter Four.

In the literature on the relationship between VFI and Quality, researchers have explored the interactions between these two factors from both direct and indirect viewpoints. From a direct perspective, moderate VFI promotes the improvement of Quality, while

excessive VFI is detrimental to it. From an indirect perspective, scholars have only examined the impact of VFI on Quality from the perspectives of Teffort, Gstructure, transfer payments, and government competition, neglecting the examination of its indirect effects on China's Quality with Teffort and Gstructure as mediating variables.

Therefore, based on its review of the theoretical and empirical literature, this study identifies key research gaps and proposes seven research hypotheses. It attempts to incorporate VFI, Teffort, Gstructure, and Quality into a unified framework to study the indirect impact of VFI on Quality and its pathways. First, it investigates the direct impact of VFI on Quality, and on this basis, proposes research hypothesis 1. Second, it adds the mediating variable of Teffort to investigate the indirect impact of VFI on Quality, and based on this, proposes research hypotheses 2, 3, and 4. Finally, it adds the mediating variable of Gstructure to study the indirect effect of VFI on Quality, and on this basis, proposes research hypotheses 5, 6, and 7.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research design and methodology. It provides a detailed description of the research framework, variable measurement methods, data sources, and the system of equations model. Subsequently, the application of the selected models and methods in data analysis is discussed. Through this chapter, the overall research blueprint, data analysis techniques, and how the study achieves its objectives are presented.

3.2 Conceptual Framework

This study focuses on the direct impact of VFI on China's Quality and the indirect impact of VFI on Quality through the adjustment of local government revenues and expenditures. Figure 3.1 illustrates the conceptual framework of this study. The first objective is to investigate the mechanism of the direct influence of VFI on Quality in China. The second objective is to explore the mechanism of the impact of VFI and Teffort on Quality. The third objective is to explore the mechanism by which VFI and Gstructure affect Quality. Figure 3.2 shows the research framework of equations Quality, Teffort and Gstructure for the development of the research hypotheses.

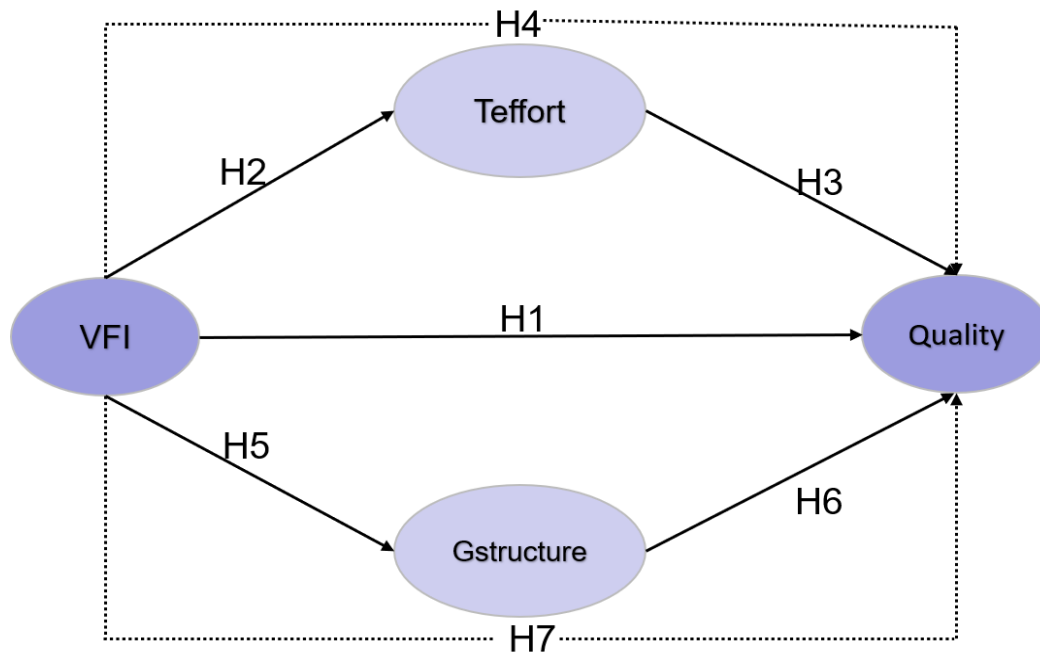


Figure 3.1 Conceptual Framework for VFI and Quality

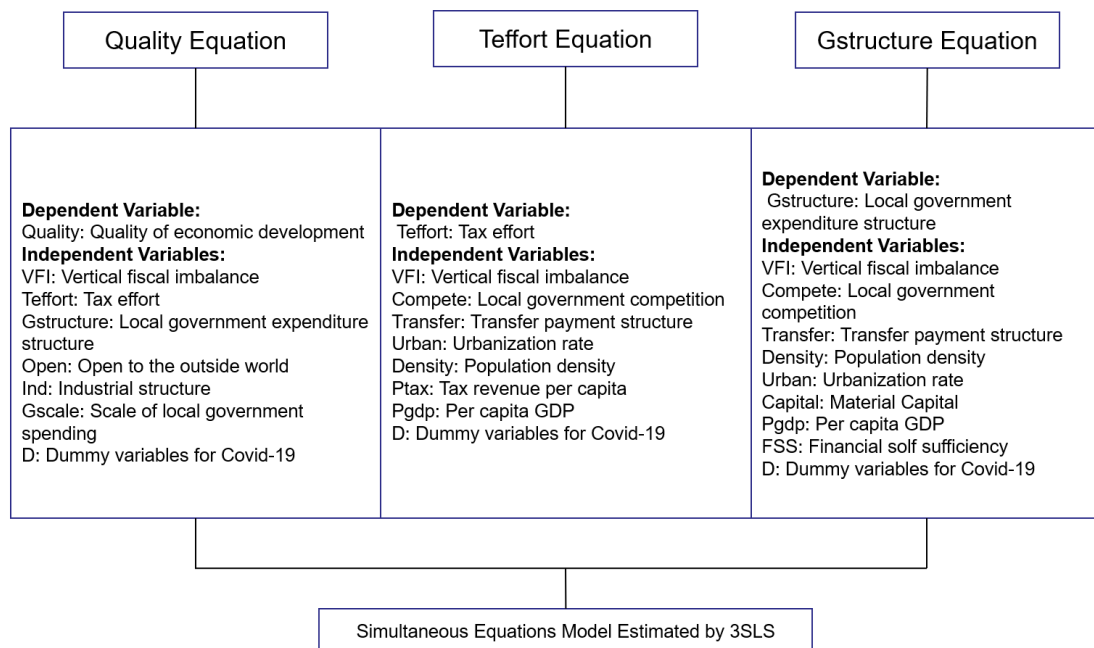


Figure 3.2 Simultaneous Equations for Quality, Teffort and Gstructure

3.3 Dependent Variable

China's 30 provinces are divided into eastern, central and western provinces by reference to the criteria in document No. 33 of the National Development. The east includes 11 regions of Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan. The centre includes 8 regions of Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan. The west includes 11 regions of Sichuan, Chongqing, Guizhou, Yunnan, Inner Mongolia, Guangxi, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.

To examine the mechanisms through which VFI, Teffort, and Gstructure influence Quality, this study uses Quality as the dependent variable. This variable is synthesized using Principal Component Analysis (PCA) according to the five development concepts.

In terms of innovative development, Schumpeter, as early as 1912, posited that innovation drives industrial transformation and changes in economic structure. Later, Grossman and Helpman (1991) found that technological innovation is closely linked to production efficiency. Empirical studies by Coe et al. (2009) revealed that both domestic and foreign R&D capital stocks significantly influence a country's total factor productivity (TFP). Shen (2018) argued that Quality in the new era requires the dual drive of technological and institutional innovation. Using the system GMM estimation method, Song and Ren (2018) found that achieving Quality requires the mutual promotion of technological progress and institutional change.

In terms of coordinated development, Chen (2018) suggested that different degrees of structural transformation can lead to income disparities. Hsieh and Klenow (2010) pointed out that resource and input factor misallocation across industries is a critical factor causing differences in TFP among countries. Chen et al. (2011) found a declining trend in the influence of industry structural change on TFP and output rise in China. Liu et al. (2017) confirmed the close relationship between economic structural optimization and Quality. Liu and An (2002) argued that industrial structural change has been a key driver of China's rapid economic growth over the past 40 years. Using a structural equation model, Liu et al. (2014) found that Quality in China suffers significantly from industrial structural imbalance. Han et al. (2019) found that industrial upgrading promotes green development in Chinese cities. Zhu and Liu (2020) confirmed the positive impact of industrial structural upgrading on Quality.

In terms of green development, Meadows et al. (2018) explored the costs of economic growth from a view of resources and the environment. Lee (2005) found a close relationship between energy consumption and output levels. Dusyk et al. (2009) argued that improving traditional methods and adopting new energy efficiency and conservation measures contribute to sustainable development. Zhang and Shi (2014), based on a general equilibrium analysis framework of division of labour, explained the evolution mechanism by which emission reduction policies can promote economic development. Hu and Zhou (2014) analysed the necessity of implementing green development by defining its functions, establishing an analytical framework, and setting strategic goals. Luo and Zhang (2016)

analysed the role of green development in building ecological civilization from the perspectives of concepts, practices, and institutions. Chen and Chen (2018) confirmed the close link between smog pollution, environmental governance, and Quality.

In terms of openness development, Alguacil et al. (2004), using a VAR model, empirically showed that the economic openness of Latin American developing countries promotes economic growth. Giles and Stromer (2006) found a strong link between trade openness and economic convergence. Sarkar (2008) showed that trade openness promotes economic growth in countries with intermediate levels of economic development. Wang and Zhang (2021) found through empirical research that trade openness positively impacts economic growth. Li and Zhang (2006) confirmed the positive influence of trade openness on economic growth. Zhao (2011), using data from 1979 to 2010, demonstrated that openness benefits the enhancement of the demographic dividend. Mao and Peng (2012) found that openness promotes economic development by comparing the economies of China and India. Gu and Chen (2016) argued that relatively increasing imports contribute to economic growth. Wei and Zhang (2019), using data from China between 2000 and 2016, confirmed that service trade imports and exports contribute to improving Quality.

In terms of shared development, Quan and Xu (2002) argued that income inequality can, to some extent, hinder China's rapid economic expansion. Yang and Zhu (2007) discovered that narrowing income gaps helps expand consumer demand and drives sustained economic growth. Ma and Bai (2015) pointed out that welfare levels are correlated with Quality. Heo and Doanh (2009) found that trade liberalization has a critical impact on

poverty levels in Indonesia, depending on the region's sensitivity to tariff reductions in output and intermediate input markets. Genicot and Ray (2017) argued that to improve Quality, nations need to address income inequality issues. Jiang et al. (2018) suggested that income and wealth distribution affect economic growth.

Therefore, this study uses the PCA method to quantify the quality of China's economic development by first determining the weights of the second-level indicators and then using the same method to determine the weights of the five first-level indicators. The specific indicators are shown in Table 3.1.

Table 3.1: Comprehensive Indicator System for Quality

Primary indicators	Secondary indicators	Specific expression	Indicator property
Innovation	Level of R&D investment	R&D investment/population	Positive
	Emphasis on technology	Technology expenditure/population	Positive
	Patent licensing	Number of patents granted per 10,000 people (pieces)	Positive
Coordination	Urban-rural structure	Urban/total population	Positive
	Financial structure	Balance of deposits and loans /GDP	Positive
	Industrial structure	Growth of tertiary industry /GDP	Positive
Greenness	Investment in environmental pollution control	Investment in environmental pollution control/Population	Positive
	Forest coverage	Forest area/land area	Positive
	Unit of output wastewater	Industrial wastewater emissions /GDP	Negative
	Unit of output of solid waste emissions	Solid waste emissions /GDP	Negative
	Power consumption per unit output	Total power consumption /GDP	Negative

Table 3.1 continued

Primary indicators	Secondary indicators	Specific expression	Indicator property
Openness	Import	Total imports /GDP	Positive
	Export	Total exports /GDP	Positive
	Foreign capital utilization ability	Total utilized foreign capital /GDP	Positive
Sharing	Education level	Average years of education	Positive
	Medical level	Number of hospital beds per 1000 people	Positive
	Convenience of transportation	Highway miles per 10,000 people	Positive
	Health care services	Health expenditure/population	Positive
	Social security level	Social Security funds/population	Positive

3.4 Independent Variables

As the dependent variable, Quality has already been defined and measured in detail earlier, this section will focus on explaining the core explanatory variables introduced in the empirical model, namely VFI, Teffort, and Gstructure.

3.4.1 Vertical Fiscal Imbalance (VFI)

Due to the difficulty of obtaining data on variables related to vertical fiscal imbalance, previous research often relies on case studies and survey methods. One of the most representative studies is by Chen (2008), who defines vertical fiscal imbalance as the disparity between national and regional authorities in terms of fiscal revenue and expenditure. He employed traditional methods of calculation to measure the fiscal imbalance gap between the central and regional authorities in China from 1978 to 2006. The results indicate that since the 1994 tax-sharing reform, the growth rate of the central government's fiscal revenue has increasingly outpaced that of regional authorities, while the growth rate of the central

government's fiscal expenditure has significantly lagged behind that of local governments. Moreover, even if all of the central government's fiscal revenue were used to cover local government expenditures, it would still be far from sufficient to bridge the gap.

Another notable study is by Jiang (2006), who defines VFI as the capacity of regional authorities to generate sufficient revenue to cover their expenditures without depending on central government transfers. He measured the fiscal revenue and expenditure gaps among national and regional authorities in China from 1978 to 2003, finding that the extent of VFI in China has deepened progressively since the tax-sharing reform. Furthermore, Jiang (2006) identifies that the degree of imbalance between the two levels of government exhibits periodic characteristics.

Jiang (2007) continued his research on VFI, this time focusing on the fiscal imbalance among multiple levels of government, breaking down the analysis into the provincial, municipal, county, and township levels. He explored the causes of imbalance and the impact of interactions among different levels of government. By 2009, Jiang (2009) conducted an empirical analysis on the measured fiscal revenue-expenditure gaps, aiming to analyse the differences in the degree of imbalance among various levels of government. The results show that the higher the level of local government, the lower the degree of VFI, while the lower the level of government, the more severe the imbalance.

Given that the asymmetric decentralization of revenue and expenditure is a significant incentive for local governments to seek extrabudgetary revenue, this study draws

on the experiences of Eyraud and Lusinyan (2013) and Chu and Shao (2018) and introduces two fiscal decentralization indicators into the empirical model to better assess the fiscal status of local governments concerning land finance. The specific formulas for calculating VFI, FDR, FDS, and FSS are shown in the table below.

Table 3.2: The Measurement Formula of VFI

Index Name	Measure Formula
VFI	$VFI = 1 - \frac{FD_R}{FD_S} \times (1 - LFSR)$
FD _R	$FD_R = \frac{LP_R / LPOP}{LP_R / LPOP + CP_R / NPOP}$
FD _S	$FD_S = \frac{LP_S / LPOP}{LP_S / LPOP + CP_S / NPOP}$
FSS	$FSS = \frac{LP_S - LP_R}{LP_S}$
Variable Definitions	
FD _R : Decentralization of Fiscal Revenue	
FD _S : Decentralization of Fiscal Spending	
LFSR: Local Financial Self-sufficiency Rate of Gap	
LP _R : Local Public Revenue	
LP _S : Local Public Spending	
CP _R : Central Public Revenue	
CP _S : Central Public Spending	
LPOP: Local Population	
NPOP: National Population	

3.4.2 Tax Effort (Teffort)

This study draws on the Teffort model proposed by scholars from the International Monetary Fund and references the work of Eyraud and Lusinyan (2013), as well as Chu and

Shao (2018), to measure China's VFI. First, local government Teffort is defined as the proportion of actual tax revenue to potential tax revenue, expressed as $Teffort = \frac{Tax}{Tax^*}$, where Tax^* represents potential tax revenue, and Tax represents actual tax revenue. Second, the tax handle method (establishing a multiple linear regression model) is used to estimate the potential tax revenue for 30 provinces in China from 2008 to 2022. Finally, the tax effort for each province is calculated using the formula $Teffort = \frac{Tax}{Tax^*}$. The specific regression model is illustrated in the figure below.

$$Tax^* = \alpha_1 + \theta_1 Pgd_{it} + \theta_2 Open_{it} + \theta_3 Density_{it} + \theta_4 Ind2_{it} + \theta_5 Ind3_{it} + \theta_6 Urban_{it} + \varepsilon_{it} \quad \text{Equation 3.1}$$

Table 3.3: Variable Definition and Calculation Formula

Variable	Variable meaning	Calculation method
Tax*	Potential tax revenue (%)	Regional tax revenue/GDP
Pgdp	Per capita GDP (RMB10 000 /person)	The logarithm of GDP/ population
Open	Degree of Openness (%)	Total exports /GDP
Density	The proportion of secondary industry (%)	Logarithmic of resident population/land area
Ind2	The proportion of secondary industry (%)	Value added of the secondary industry /GDP
Ind3	The proportion of tertiary industry (%)	Value added of tertiary industry /GDP
Urban	Urbanization level (%)	Urban population/total population

3.4.3 Local Government Expenditure Structure (Gstructure)

Currently, scholars mainly adopt two approaches to measure Gstructure: (i) calculating the proportion of various expenditures to the total government spendings, and (ii) reflecting the quantitative proportion and combination of various public expenditures. Although there are multiple theoretical classifications of public expenditure, given the Central Committee of the Communist Party of China's commitment to a people-centred

governance philosophy since the 18th National Congress, which positions improving people's livelihood as one of the two fundamental tasks in developing a moderately affluent society, and elevates livelihood projects to a new height in the 19th National Congress report as the original mission of the Party, the realization of local governments' social welfare functions can be reflected in the proportion of livelihood-related expenditures within their public spending. It is generally believed that compared to government investment expenditures, a higher proportion of livelihood-related expenditures indicates a higher level of public service provision by the local government, which in turn promotes Quality.

Therefore, this study draws on the methodology of Chu and Shao (2018) and uses the share of livelihood-related expenditures in total public expenditure to measure the bias in the structure of public expenditure. Specifically, a higher proportion of livelihood-related expenditures indicates that local government fiscal spending is more aligned with the value goal of being people-centred and governance for the people, and it also reflects a more rational Gstructure. The specific formula is as follows:

$$Gstructure = \frac{Mspend}{LP_s} \quad \text{Equation 3.2}$$

where Gstructure represents the bias in public expenditure structure, with values ranging from 0 to 1. A value of Gstructure closer to 0 indicates a greater bias towards economic expenditure in the public expenditure structure, while a value closer to 1 represents a more optimized expenditure structure. Additionally, Mspond refers to government livelihood-related expenditures, including general public services, public safety, science,

education, culture, and health, social security and employment, and housing security expenditures. LGS represents local government public budget expenditures.

3.5 Control Variables

To examine the impact of VFI, Teffort, and Gstructure on Quality, this study introduces the following control variables: openness to the outside world, industrial structure, per capita GDP, scale of local government spending, population density, local government competition, structure of transfer payments, urbanization, per capita tax revenue, fiscal self-sufficiency, material capital, and the COVID-19 pandemic. Additionally, this study discusses how to measure these control variables.

Table 3.4: Selection Criteria for the Variables in Quality Equation

Variable types	Variable names	Selection basis	Citations
Dependent Variable	Quality	A comprehensive indicator for measuring regional economic development quality	Chu & Shao (2018)
Independent Variables	VFI	Affecting resource allocation efficiency by distorting central-local incentives	Oates (1972)
	Teffort	Reflecting local government fiscal behaviour and influencing economic sustainability	Dahlby & Wilson (1994)
	Gstructure	Directly affecting the quality of economic development	Liu et al. (2023)
Control Variables	Open	Promoting efficiency improvement through technological spillovers and market competition	Wei & Li (2018)
	Ind	Reflecting the level of economic transformation	Chen et al. (2019)
	Gscale	Improving public services	Jin (2018)

3.5.1 Open to the Outside World (Open)

Since the reform and opening-up, imports and exports have been key drivers of China's rapid economic growth. They have played a crucial role in expanding foreign investment and promoting domestic product exports, becoming important drivers of Quality in China. However, as the international trade landscape changes, the impact of openness on domestic economic growth quality may also shift. Therefore, drawing on the research of Wei and Li (2018), this study incorporates this indicator into the empirical analysis. Specifically, the indicator is calculated by converting the total value of imports and exports into RMB based on the average USD exchange rate, then dividing by each province's GDP.

3.5.2 Industrial Structure (Ind)

Upgrading industrial structure reflects changes in the alignment between local economic development and resource endowment. In theory, optimizing and upgrading the industrial structure can enhance the efficiency of local resource allocation, thereby continuously improving Quality. Drawing on the research of Chen et al. (2019), the specific indicator for industrial structure is calculated by the share of the tertiary sector's value added in GDP.

3.5.3 Per Capita GDP (Pgdp)

Per capita GDP is an important indicator of a country's economic scale and level of economic activity. It is often used as one of the measures to assess a country's level of economic development and the standard of living of its residents, thus having a substantial

effect on Quality. Drawing on the research of Liu (2018), this study calculates it by dividing the GDP by the population of each region.

3.5.4 Scale of Local Government Expenditure (Gscale)

Gscale reflects the level of local government engagement in the regional economy and is a key means of regional authority expenditure competition. To some extent, it reflects the influence of government investment on improving Quality. Drawing on the research of Jin (2018), the specific indicator for local government spending scale is calculated by the ratio of general public budget expenditure to provincial GDP.

Table 3.5: Selection Criteria for the Variables in Teffort Equation

Variable types	Variable names	Selection basis	Citations
Dependent Variable	Teffort	Reflecting local government tax capacity and behavioural incentives	Liu & Liu (2015)
Independent Variable	VFI	Influencing local tax effort through dependence on transfer payments	Qian & Weingast (1997)
Control Variables	Compete	Suppressing tax effort	Miu et al. (2017)
	Transfer	Affecting local fiscal autonomy	Wang & Yin (2019)
	Urban	Enhancing the tax base size and tax administration efficiency	Wei et al. (2021)
	Density	Tax collection costs are lower in areas with high population density.	Ren & Li (2018)
	Ptax	Reflecting the abundance of regional tax sources	Liu & Zhang (2022)
	Pgdp	Affecting the tax base structure and tax collection difficulty	Hettich & Winer (1986)

3.5.5 Population Density (Density)

This indicator reflects the influence of population concentration on Quality. In theory, areas with high population density may lead to congestion in the use of public goods, thus reducing residents' sense of well-being. However, it may also lead to increased innovation and output through the agglomeration effect. Therefore, its impact on Quality remains to be verified. Drawing on the research of Ren and Li (2018), the specific population density index is calculated by the ratio of the total population at the end of the year to the land area of each province, and then taking the natural logarithm of this index.

3.5.6 Local Government Competition (Compete)

Compete refers to the horizontal competition among local governments under a politically centralized and economically decentralized system, where regional authorities compete to create stronger economic performance and achieve more promotion advantages. Based on this definition, it is clear that under the incentives of promotion champions and economic champions, local governments' main competitive goal is economic development. Hence, this study, drawing on the research of Miu et al. (2017), constructs a local government competition index using the GDP index. The specific calculation formula for this index is as follows:

$$Compete = \frac{\text{highest Pgdp adjacent provinces}}{\text{Provincial Pgdp}} \times \frac{\text{highest Pgdp provinces}}{\text{Provincial Pgdp}} \quad \text{Equation 3.3}$$

3.5.7 Transfer Payment Structure (Transfer)

General transfer payments have a good financial balance effect, and the higher their proportion, the more favourable it is for the balancing effect of the transfer payment system, thereby continuously improving Quality. Drawing on the research of Wang and Yin (2019), specifically, the total amount of transfer payments is obtained by adding general transfer payments, special transfer payments, and tax rebates, and then calculating the proportion of general transfer payments.

3.5.8 Urbanization Rate (Urban)

The rapid advancement of new urbanization can promote rapid economic development through economies of scale and agglomeration effects. Therefore, based on the research by Wei et al. (2021), this indicator is also included in the study, calculated as the share of urban population to the permanent resident population for each province.

Table 3.6: Selection Criteria for the Variables in Gstructure Equation

Variable types	Variable names	Selection basis	Citations
Dependent Variable	Gstructure	Reflecting local government resource allocation preferences	Chu & Shao (2018)
Independent Variable	VFI	Forcing local governments to adjust expenditure directions through dependence on transfer payments	Qian & Roland (1998)
Control Variables	Compete	Driving the bias toward infrastructure expenditure	Zhou (2007)
	Transfer	Constraining local expenditure flexibility	Wang & Yin (2019)
	Density	Areas with high population density have higher public service demands, forcing an increase in the proportion of expenditure on public welfare.	Ren & Li (2018)

Table 3.6 continued

Variable types	Variable names	Selection basis	Citations
Control Variables	Urban	Driving the expansion of public service expenditure	Wei et al. (2021)
	Capital	The stock of physical capital may lock in future maintenance expenditure pathways.	Chao & Shen (2014)
	FSS	Regions with higher fiscal self-sufficiency have greater expenditure autonomy, which may lead to an optimized expenditure structure.	Liu et al. (2019)
	Pgdp	Affecting the capacity for expenditure upgrading	Liu (2018)

3.5.9 Per Capita Tax (Ptax)

The level of Ptax reflects, to some extent, the fiscal capacity of regional authorities, and thus can have a significant effect on Quality. Considering the potential nonlinear effect of changes in Teffort on Quality, this study introduces Ptax indicator to control for the impact of income behaviour adjustment. Drawing on the research of Liu and Zhang (2022), the specific indicator is calculated by taking the natural logarithm of the actual Ptax in each province, adjusted by the deflator index (2008=100) to remove price factors.

3.5.10 Financial Self-sufficiency (Fss)

The fiscal self-sufficiency rate reflects the portion of regional government expenditure met by its own revenues. The higher this rate, the more abundant the local financial resources. Generally, when Fss is high, the fiscal revenue-expenditure gap is smaller, reducing the economic and fiscal expenditure pressure on local governments, thereby promoting an increase in private expenditure. Conversely, when Fss is low, regional

authorities may strengthen investment management of economic expenditures to reach the target of economic growth constraints, ultimately causing fiscal expenditure to lean more towards economic construction (Liu et al., 2019). Thus, in theory, the higher the fiscal self-sufficiency rate, the more stable the local government's revenue expectations, and the more likely it is to improve Quality by enhancing government efficiency. This study measures Fss by the ratio of general budget revenue to general budget expenditure.

3.5.11 Material Capital (Capital)

Since the reform and opening-up in 1978, the rapid accumulation of material capital has been an important foundation for driving China's rapid economic growth. Therefore, this indicator is also included in the equation for Quality. The specific indicator is derived from the practice of Chao and Shen (2014), calculated by the ratio of actual fixed asset formation to actual GDP in each province.

3.5.12 Dummy Variable for Covid-19 (D)

In this study, a dummy variable representing the Covid-19 pandemic was included to account for its potential impact on the dependent variable. The Covid-19 dummy variable takes the value of 1 for pandemic 2020-2022 and 0 otherwise. With this dichotomous variable, we can isolate and measure the impact of the Covid-19 pandemic on the outcomes of interest while controlling for the other factors in the model. By including this variable, we aim to capture the unique disturbances and economic changes induced by the pandemic, ensuring more accurate estimates of the model parameters.

3.6 Data Sources

The original data for the variables used in this study were obtained from a variety of sources, including the China Statistical Yearbook, China Financial Yearbook, China Urban Statistical Yearbook, National Government Debt Audit Results, China Land and Resources Yearbook, Wind database, China Economic Network Statistical Database, provincial financial budget reports, and other relevant publications.

Considering that China implemented a new government revenue and expenditure classification standard and statistical calibre in 2007, and due to the lack of statistical data for the Tibet region, the sample period selected in this study is 2008-2022, and the sample range includes 30 provinces, municipalities, and autonomous regions in China, excluding Tibet, Hong Kong, Macau, and Taiwan.

3.7 Pre-Modelling Analysis

In econometrics, the methods for estimating simultaneous equations can be broadly divided into single-equation estimation methods and system estimation methods. The single-equation estimation method involves estimating each equation separately without considering the constraints of other equations. Therefore, it cannot fully utilize the constraints and additional information from other equations, relying only on limited information. In contrast, the system estimation method, also known as the full information estimation method, fully utilizes the constraints and information from all equations when

estimating each equation. This method can estimate all equations in a simultaneous equation system at the same time, thereby determining the estimates of all parameters simultaneously.

Three-Stage Least Squares (3SLS) is a system estimation method proposed by Zellner and Theil (1962). It is a logical extension of the Two-Stage Least Squares (2SLS) method. Its main idea is: (i) 2SLS uses only a part of the model's information and ignores the full constraints imposed by the model structure on the parameter values of other equations. (ii) It ignores the contemporaneous correlation of the random disturbance terms across equations, i.e., $E(U_i U_j) \neq 0$, where i refers to the equation (i) and j refers to the equation (j).

Therefore, single-equation estimation methods are not very efficient, and there is a need for improvement. The improvement method is to introduce Generalized Least Squares (GLS). Thus, the first and second stages of 3SLS are the same as 2SLS, and the third stage involves the application of GLS. The 3SLS method has better asymptotic efficiency compared to the 2SLS method.

Consider a model that includes G endogenous variables and K predetermined variables. The equation (i) is expressed as:

$$Y_i = \tilde{Y}_i \beta_i + X_i \gamma_i + u_i, \quad i = 1, 2, \dots, G \quad \text{Equation 3.4}$$

where Y_i is the $(n \times 1)$ vector of sample observations for the dependent variable in the equation (i). $\tilde{Y}_i$ is the $(n \times \delta_i)$ sample matrix of endogenous variables as independent variables in the equation (i). β_i is a $(\delta_i \times 1)$ parameter vector; X_i is the $(n \times k_i)$

sample matrix of predetermined variables in the equation (i). γ_i is a $(k_i \times 1)$ parameter vector, and u_i is the $(n \times 1)$ vector of random disturbances in the equation (i).

The matrix form of equation (3.4) is:

$$Y_i = (\tilde{Y}_i, X_i) \begin{pmatrix} \beta_i \\ \gamma_i \end{pmatrix} + u_i \quad \text{Equation 3.5}$$

$$Z_i = (\tilde{Y}_i, X_i), \quad b_i = \begin{pmatrix} \beta_i \\ \gamma_i \end{pmatrix}, \quad \text{Equation 3.6}$$

Then equation (3.5) can be rewritten as:

$$Y_i = Z_i b_i + u_i, \quad i = 1, 2, \dots, G \quad \text{Equation 3.7}$$

First Stage: Transforming the model into reduced form

Rewrite model (3.4) into its reduced form:

$$y_{it} = \pi_{i1}x_{1t} + \pi_{i2}x_{2t} + \dots + v_t \quad i = 1, 2, \dots, G \quad \text{Equation 3.8}$$

Substitute the sample observations:

$$\begin{pmatrix} y_{i1} \\ y_{i2} \\ \vdots \\ y_{in} \end{pmatrix} = \begin{pmatrix} x_{11} & x_{21} & \dots & x_{k_i1} \\ x_{12} & x_{22} & \dots & x_{k_i2} \\ \vdots & \vdots & \vdots & \vdots \\ x_{1n} & x_{2n} & \dots & x_{k_in} \end{pmatrix} \begin{pmatrix} \pi_{i1} \\ \pi_{i2} \\ \vdots \\ \pi_{ik_i} \end{pmatrix} + \begin{pmatrix} v_{i1} \\ v_{i2} \\ \vdots \\ v_{ik_i} \end{pmatrix} \quad \text{Equation 3.9}$$

Simplify as:

$$Y_i = \underset{n \times 1}{X} \underset{(n \times k_i)(k_i \times 1)}{\prod_i} + \underset{(n \times 1)}{V_i}, \quad i = 1, 2, \dots, G \quad \text{Equation 3.10}$$

Apply the Ordinary Least Squares (OLS) method to each equation in model (3.10) to obtain the estimates of $\hat{Y}_1, \hat{Y}_2, \dots, \hat{Y}_G$.

Second Stage

Substitute $\hat{Y}_1, \hat{Y}_2, \dots, \hat{Y}_G$ into the structural equation (3.7) on the right-hand side, and apply the Ordinary Least Squares (OLS) method to the transformed equation to obtain the 2SLS estimates of $\beta_i, \gamma_i (i=1, 2, \dots, G)$. These estimates are then used to estimate the random disturbance terms u_i in each equation, yielding the estimated disturbance terms $\hat{u}_1, \hat{u}_2, \dots, \hat{u}_G$. Note that here $\hat{u}_i$ is an $(n \times 1)$ column vector.

Third Stage

We already know that X is the $(n \times k)$ matrix of observations for all predetermined variables. By left-multiplying equation (3.7) by X' , we obtain the system of KG equations:

$$\begin{cases} X'Y_1 = X'Z_1 b_1 + X'u_1, \\ X'Y_2 = X'Z_2 b_2 + X'u_2, \\ \vdots \\ X'Y_G = X'Z_G b_G + X'u_G, \end{cases} \quad \text{Equation 3.11}$$

In matrix form, this can be written as:

$$\begin{pmatrix} X'Y_1 \\ X'Y_2 \\ \vdots \\ X'Y_G \end{pmatrix} = \begin{pmatrix} X'Z_1 & & & \\ & X'Z_2 & & \\ & & \ddots & \\ & & & X'Z_G \end{pmatrix} \begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_G \end{pmatrix} + \begin{pmatrix} X'u_1 \\ X'u_2 \\ \vdots \\ X'u_G \end{pmatrix}. \quad \text{Equation 3.12}$$

Simplified notation:

$$Y = Zb + U, \quad \text{Equation 3.13}$$

where:

$$Y = \begin{pmatrix} X'Y_1 \\ X'Y_2 \\ \vdots \\ X'Y_G \end{pmatrix}, Z = \begin{pmatrix} X'Z_1 & & \\ & X'Z_2 & \\ & & \ddots \\ & & & X'Z_G \end{pmatrix}, b = \begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_G \end{pmatrix}, U = \begin{pmatrix} X'u_1 \\ X'u_2 \\ \vdots \\ X'u_G \end{pmatrix}. \quad \text{Equation 3.14}$$

Clearly, the composite disturbance term U varies with the matrix X' , and thus exhibits heteroskedasticity. Therefore, Generalized Least Squares (GLS) should be applied.

However, the computation of GLS requires knowing the covariance matrix of U .

Address the calculation of the covariance matrix of U :

Each equation has n observations. Denote the contemporaneous covariance of the random disturbance terms between the equation (i) and equation (j) as σ_{ij} , assuming that the random disturbances at different times are uncorrelated. The $n \cdot G$ random disturbances of the original model can be defined as a matrix:

$$u = \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_G \end{pmatrix} \quad \text{Equation 3.15}$$

$$COV(u) = E(uu') = E \begin{pmatrix} u_1 u_1' & u_1 u_2' & \cdots & u_1 u_G' \\ u_2 u_1' & u_2 u_2' & \cdots & u_2 u_G' \\ \cdots & \cdots & \cdots & \cdots \\ u_G u_1' & u_G u_2' & \cdots & u_G u_G' \end{pmatrix} = \begin{pmatrix} \sigma_{11}I & \sigma_{12}I & \cdots & \sigma_{1G}I \\ \sigma_{21}I & \sigma_{22}I & \cdots & \sigma_{2G}I \\ \cdots & \cdots & \cdots & \cdots \\ \sigma_{G1}I & \sigma_{G2}I & \cdots & \sigma_{GG}I \end{pmatrix} \quad \text{Equation 3.16}$$

$$\Phi = COV(U) = E(UU') = E(X'uu'X) = X'E(uu'X) \quad \text{Equation 3.17}$$

Substituting equation (3.16) into (3.17) gives:

$$\Phi = COV(U) = \begin{pmatrix} \sigma_{11}X'X & \sigma_{12}X'X & \dots & \sigma_{1G}X'X \\ \sigma_{21}X'X & \sigma_{22}X'X & \dots & \sigma_{2G}X'X \\ \dots & \dots & \dots & \dots \\ \sigma_{G1}X'X & \sigma_{G2}X'X & \dots & \sigma_{GG}X'X \end{pmatrix} \quad \text{Equation 3.18}$$

Since u is unobservable, we cannot directly obtain σ_{ij} . Therefore, we use the estimated values $\hat{\sigma}_{ij}$. $\hat{\sigma}_{ij}$ can be calculated using the estimated disturbance vector $\hat{u}_i$ from the second stage:

$$\hat{\sigma}_{ij} = \frac{\hat{u}_i' \hat{u}_j}{\sqrt{(n - k_i - \delta_i)(n - k_j - \delta_j)}} \quad \text{Equation 3.19}$$

Substituting equation (3.16) into (3.15) gives $\hat{\Phi}$. With this, we can apply GLS to equation (3.10). According to the formula for GLS, we obtain:

$$\hat{b} = \left(Z' \hat{\Phi}^{-1} Z \right)^{-1} Z' \hat{\Phi}^{-1} Y \quad \text{Equation 3.20}$$

This is 3SLS estimator. Compared to other methods, 3SLS offers significant advantages in addressing endogeneity issues and estimating simultaneous equation systems. Specifically:

First, although easy to implement, OLS (Ordinary Least Squares) fails to address endogeneity, which may lead to biased and inconsistent estimates. Second, while capable of handling endogeneity in dynamic panel data models, GMM (Generalized Method of Moments) is mainly suitable for short panel data and may suffer from weak instrument problems when the sample size is small. Furthermore, GMM is relatively limited in estimating multi-equation systems. Third, although SUR (Seemingly Unrelated Regression)

can be used for multi-equation estimation, it does not effectively correct for endogeneity, making it unsuitable for analyzing the interaction between VFI and Quality. Fourth, typically applied to policy shocks or natural experiments, DID (Difference-in-Differences) is effective in handling time and individual fixed effects. However, it is not appropriate for the structural simultaneous equation model.

The reasons for choosing 3SLS in this study are as follows:

First, 3SLS jointly estimates the system of equations, effectively controlling for endogeneity bias while improving estimation efficiency. Second, since VFI, Teffort, and Gstructure have bidirectional effects, 3SLS allows for simultaneous estimation of this bidirectional relationship, avoiding the potential bias of single-equation models. Third, compared to 2SLS, 3SLS incorporates the SUR estimation technique, enhancing efficiency when cross-equation error correlation exists.

3.8 Model Development

Based on the theoretical framework analysis of the multiple mechanisms by which VFI, Teffort, and Gstructure affect Quality, this study argues that VFI not only directly impacts Quality but also indirectly affects it through its influence on Teffort and Gstructure. Therefore, this study suggests that a single-equation model may not adequately capture the multiple complex mechanisms among the three factors and may overlook potential endogeneity issues. Hence, a panel simultaneous equations model is considered to

empirically study the interaction mechanisms and transmission effects among the three factors, resulting in the establishment of the simultaneous equations model.

To test the research hypotheses, this section draws on the empirical study by Chu et al. (2021) and creates a system of panel simultaneous equations as indicated in equations (3.21), (3.22), and (3.23).

$$Quality_{it} = \lambda_0 + \alpha_1 VFI_{it} + \alpha_2 Teffort_{it} + \alpha_3 Gstructure_{it} + \alpha_4 Open_{it} + \alpha_5 Ind_{it} + \alpha_6 Gscale_{it} + \lambda_1 D_{it} + \varepsilon_{1it} \quad \text{Equation 3.21}$$

$$Teffort_{it} = \rho_0 + \beta_1 VFI_{it} + \beta_2 Compete_{it} + \beta_3 Transfer_{it} + \beta_4 Urban_{it} + \beta_5 Density_{it} + \beta_6 Ptax_{it} + \beta_7 Pgdp_{it} + \rho_1 D_{it} + \varepsilon_{2it} \quad \text{Equation 3.22}$$

$$Gstructure_{it} = \tau_0 + \gamma_1 VFI_{it} + \gamma_2 Compete_{it} + \gamma_3 Transfer_{it} + \gamma_4 Density_{it} + \gamma_5 Urban_{it} + \gamma_6 Capital_{it} + \gamma_7 FSS_{it} + \gamma_8 Pgdp_{it} + \tau_1 D_{it} + \varepsilon_{3it} \quad \text{Equation 3.23}$$

3.9 Model Tests

As this study uses panel data, model analysis testing is also required before conducting regression analyses to ensure that the appropriate model is used in the regression tests. Once the suitable panel data model has been determined, the regression tests can be performed.

3.9.1 Stationarity Test

Given the extended period and large sample size of the panel data in this study, which increases the risk of spurious regression, both the LLC test and the Fisher-ADF test were employed to perform a stationarity test on the data to determine the presence of unit roots.

The unit root test model is as follows:

$$y_{it} = \rho_i y_{i,t-1} + X'_{it} \beta_i + \mu_{it} \quad \text{Equation 3.24}$$

where $i=1, 2, \dots, N$, denotes cross-sectional individuals; $t=1, 2, \dots, T$, denotes observation period; and X'_{it} denotes exogenous variables. ρ_i is the autoregressive coefficient. If $|\rho_i| < 1$, it means that the sequence y_{it} is smooth, i.e. there is no unit root; if $|\rho_i| = 1$, it means that the sequence y_{it} is non-smooth, i. e. there is a unit root.

The LLC test assumes that ρ_i satisfies $\rho_i = \rho$ for all i , i. e. has the same unit root (Levin et al., 2002; Zhang & Wang, 2020). In contrast, the Fisher-ADF test assumes that ρ_i is not the same for all i , i.e., has different unit roots (Maddala & Wu, 1999; Choi, 2001; Keshab, 2019).

3.9.2 Multicollinearity Test

In panel data analysis, multicollinearity refers to the issue of high correlation among explanatory variables. If not addressed, multicollinearity can lead to instability in regression coefficients and unreliability in statistical test results. This study employs the Variance Inflation Factor (VIF) to examine multicollinearity in panel data. The principle behind VIF

is to assess the severity of multicollinearity by measuring the extent to which the variance of each explanatory variable is influenced by other explanatory variables. The specific steps are as follows.

First, for each explanatory variable X_i in the model, perform a regression where X_i is the dependent variable and the remaining explanatory variables are the independent variables, then calculate the coefficient of determination R_i^2 . Next, compute the VIF value for each explanatory variable using the formula $VIF(X_i) = \frac{1}{1-R_i^2}$. If the VIF value is less than 10, multicollinearity is not considered severe; otherwise, multicollinearity is present (O'Brien, 2007; Bauer & Smith, 2023; Chen & Yang, 2024).

3.9.3 Breusch-Pagan LM Test

Breusch-Pagan Lagrange Multiplier test was proposed by Trevor S. Breusch and Adrian R. Pagan in 1979. It is a statistical test method for panel data used to detect whether a random effects model is more appropriate than a simple pooled OLS model. Its null hypothesis H_0 is: no random effects, i.e., the variance of individual effects or time effects is zero. If the null hypothesis is rejected, it indicates the presence of random effects, making the random effects model more suitable.

The computation steps are as follows: first, perform a pooled OLS regression on the panel data and calculate the residuals. Then, calculate the LM statistic based on the residuals, and compare the calculated LM statistic with the chi-square distribution to determine whether to reject the null hypothesis. In Stata, the Breusch-Pagan LM test is performed by

inputting the command “xttest0”. If the p-value corresponding to the chi-square statistic is less than 5%, reject the null hypothesis, indicating the presence of random effects. This suggests that for this panel data, random effects are preferable to pooled OLS regression. Conversely, if the p-value is greater than 5%, accept the null hypothesis, implying that pooled OLS regression is preferable to random effects (Breusch & Pagan, 1979; Greene, 2018; Hoechle, 2022).

3.9.4 Robust Hausman Test

The Hausman test is a widely used diagnostic method in panel data models for comparing the validity of fixed effects and random effects models. The basic assumption is that there should be no systematic difference in the coefficients estimated by the two models. Specifically, if the random effects model is correct, the estimates from the fixed effects model should be consistent but potentially less efficient (i.e., with higher variance). If the assumption of the random effects model is not valid (i.e., if individual effects are correlated with the explanatory variables), the estimates from the fixed effects model remain consistent, while the estimates from the random effects model will be inconsistent.

If there is heteroskedasticity and autocorrelation, the results of the original Hausman test may be invalid. In this case, the Sargan-Hansen test can be used to adjust the original model (Arellano & Bond, 1991; Davidson & Mackinnon, 2004; Wooldridge, 2010). To maintain robustness in the presence of heteroskedasticity and autocorrelation, a robust

Hausman test is performed by adding the 'xtoverid' command to the regression on the panel data:

If the p-value corresponding to the chi-square statistic is less than 5%, reject the null hypothesis, indicating the presence of individual effects. Therefore, for this panel data, the fixed effects model is preferred over the random effects model. Conversely, if the p-value is greater than 5%, accept the null hypothesis, implying that random effects model is preferable to fixed effects model (Sargan, 1958; Hansen, 1982; Ahn & Schaefer, 2022).

3.9.5 Durbin-Wu-Hausman Test

The Durbin-Wu-Hausman (DWH) test is a method used to detect endogeneity issues in a model, particularly suitable for panel data situations. It determines endogeneity problems by comparing the differences between Ordinary Least Squares (OLS) and Instrumental Variables (IV) estimates. If endogeneity is not present, i.e., if the endogenous variables are uncorrelated with the error term, OLS and IV estimates should be consistent. However, if endogeneity is present, meaning the endogenous variables are correlated with the error term, the estimates from OLS and IV will differ significantly. The DWH test assesses whether there is endogeneity by examining these differences between the two estimates.

If the p-value from the DWH test is less than the chosen significance level 5%, the null hypothesis (that the endogenous variables are uncorrelated with the error term) is rejected, indicating the presence of endogeneity. Conversely, if the p-value is greater than

the significance level 5%, the null hypothesis cannot be rejected, suggesting there is no significant endogeneity issue (Bartik & Kline, 2020; Chen & Zhang, 2024). By performing the Durbin-Wu-Hausman test, we can evaluate the endogeneity problems in the model, thereby ensuring the robustness and validity of the regression results.

3.9.6 Model Identification

Assume a system of simultaneous equations contains g endogenous variables and k exogenous variables, where the equation (i) includes g_i endogenous variables and k_i exogenous variables. Let π represent the reduced form coefficient matrix, and (B, Γ) represent the structural coefficient matrices of the simultaneous equations system. The identification condition for the equation (i) is as follows:

(i) Necessary Condition for Identification

$$k - k_i \geq g_i - 1 \quad \text{Equation 3.25}$$

The inequality above indicates that the number of exogenous variables excluded from the equation should be no less than the number of endogenous variables in the equation. This condition is also known as the order condition.

(ii) Sufficient Condition for Identification

In a model with g endogenous variables, the equation is identifiable if at least one $(g - 1) \times (g - 1)$ non-zero determinant can be constructed from the coefficient matrix of the endogenous variables included in the model but excluded from this particular equation.

There are two cases of identification: exact identification and over-identification:

The coefficients of the structural equation are unique, which occurs when $k - k_i = g_i - 1$, indicating the equation is exactly identified. Besides, the coefficients of the structural equation are not unique and have multiple solutions. This occurs when $k - k_i > g_i - 1$, indicating the equation is over-identified.

So, there are three steps for model identification. First, consider the order condition. If the order condition is not satisfied, the equation is not identifiable. Second, if the order condition is satisfied, consider the rank condition. If the rank condition is not satisfied, the equation is not identifiable. Third, if the rank condition is satisfied, determine whether the equation is over-identified or exactly identified based on the order condition (Andrews & Mikusheva, 2020; Zhang & Liu, 2023; Gao & Xu, 2024).

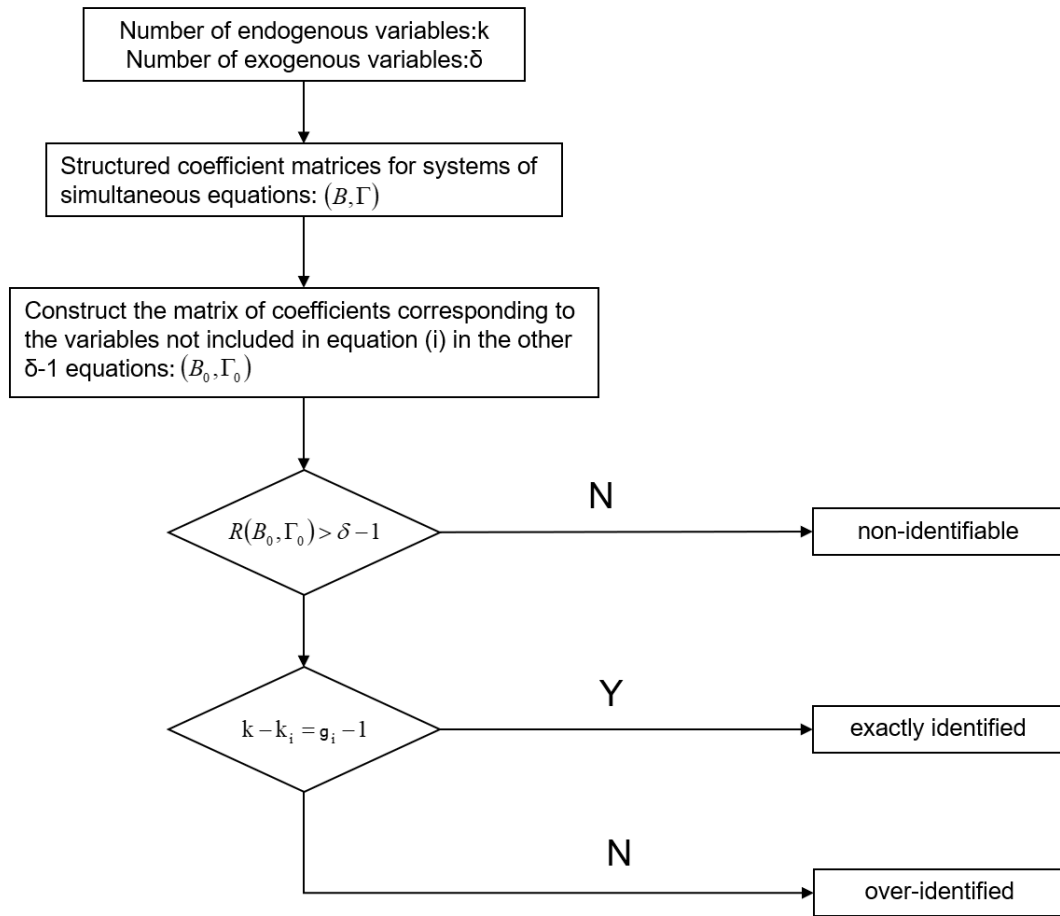


Figure 3.3: Steps in the Identification of Simultaneous Equations Model

Sources: Compiled by the author from the steps for identifying systems of simultaneous equations models in 3.9.6.

3.10 Diagnostic Evaluation

3.10.1 Heteroscedasticity Test

In panel data models, heteroskedasticity means that the variance of the error term σ_i^2 is not constant but is related to some explanatory variables or varies across individuals or over time. Heteroskedasticity can affect the efficiency and consistency of estimators, making it crucial to conduct tests for heteroskedasticity. This study uses the Modified Wald Test to test for heteroskedasticity. The specific steps are as follows.

First, estimate the fixed effects model and obtain the residuals $\hat{\mu}_{it}$. Then, calculate the individual residual variances $\sigma_i^2 = \frac{1}{T} \times \sum_{t=1}^T \hat{\mu}_{it}^2$. Finally, construct the test statistic W to test whether the individual residual variances are equal. The formula for the test statistic is as follows:

$$W = \sum_{i=1}^N \frac{(n_i-1) \times \sigma_i^2}{\sigma^2} \quad \text{Equation 3.26}$$

Where n_i is the number of observations for individual i , σ_i^2 is the residual variance for individual i , and σ^2 is the overall residual variance. By comparing the computed modified Wald statistic with the critical value of the χ^2 distribution, we decide whether to reject the null hypothesis (H_0 : no heteroskedasticity). In Stata, the Modified Wald Test is performed by inputting the command “xttest3,” If the p-value corresponding to the chi-square statistic is less than 5%, reject the null hypothesis, indicating the presence of heteroskedasticity. Conversely, if it is greater than 5%, accept the null hypothesis, indicating no presence of heteroskedasticity (Harris & Sollis, 2003; Maddala & Lahiri, 2022).

3.10.2 Serial Correlation Test

In panel data analysis, autocorrelation refers to the correlation of error terms across different time points. If not addressed, autocorrelation can lead to biased estimators and invalid hypothesis tests. This study employs the Wooldridge Test to detect potential autocorrelation in panel data models. The test is based on the fixed effects model and determines the presence of first-order autocorrelation by estimating the autocorrelation of

residuals. The null hypothesis of the test is no autocorrelation, meaning the residuals are uncorrelated.

The specific steps are as follows. First, estimate the fixed effects model for the panel data to obtain the residuals $\hat{e}_{it}$. Then, regress the residuals using the model $\hat{e}_{it} = \rho\hat{e}_{i,t-1} + \mu_{it}$, where ρ is the autocorrelation coefficient, and μ_{it} is the white noise error term. Finally, calculate the F-statistic to test the null hypothesis $\rho = 0$. In Stata, the Wooldridge Test is performed by inputting the command `xtserial`. If the p-value corresponding to the F statistic is less than 5%, reject the null hypothesis, indicating the presence of autocorrelation. Conversely, if it is greater than 5%, accept the null hypothesis, indicating no presence of autocorrelation (Newey & West, 2018; Drukker & Gates, 2021; Mikhed & Zhuang, 2021).

3.11 Summary of the Chapter

This chapter describes the research framework, research variables, data collection, and research methodology. The research framework describes how VFI directly affects Quality and how VFI indirectly affects Quality through Teffort and Gstructure of local governments. The research variables include the explanatory variable Quality, the core explanatory variables VFI, Teffort and Gstructure, and a series of control variables. Considering China's budget reform in 2007 and the missing data from Tibet, the research data in this study is the annual data of 30 provinces in China from 2008 to 2022.

After comparing the advantages and disadvantages of single-equation estimation methods and system estimation methods, this study concludes that the 3SLS method in

system estimation can better utilize the available information to regress the simultaneous equations system, yielding efficient and consistent estimates. Therefore, to test research hypotheses, the joint equations are estimated using the 3SLS approach. Additionally, this study provides a detailed introduction to the necessary tests to perform before conducting panel equation regression, such as unit root tests, multicollinearity tests, heteroskedasticity tests, autocorrelation tests, BP tests, Hausman tests and Durbin-Wu-Hausman tests, to ensure that the system of equations yields efficient and robust regression results.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results of the empirical tests based on the research process described in the previous chapter. First, it provides descriptive statistics for the dependent variable and the key explanatory variables. Next, it performs diagnostic tests on the variables. Following this, it offers a detailed introduction to the three-stage least squares estimation of VFI on Quality through local government Teffort and Gstructure. These estimation results help do what for or to in-depth research on the influence of VFI on Quality from 2008 to 2022. Finally, the chapter concludes with a summary of the hypotheses in light of the empirical research results.

4.2 Description Statistics

This section provides descriptive statistics for the core independent variables VFI, Teffort, and Gstructure, as well as the dependent variable Quality .

4.2.1 Analysis of Vertical Fiscal Imbalance

Based on the previous definition of VFI, this study measures the degree of VFI in China, but due to the lack of relevant data for Tibet, it is only possible to do so for 30 provinces from 2008 to 2022. The specific results of the measurement appear in Figure 4.1 and Table 4.1 below.

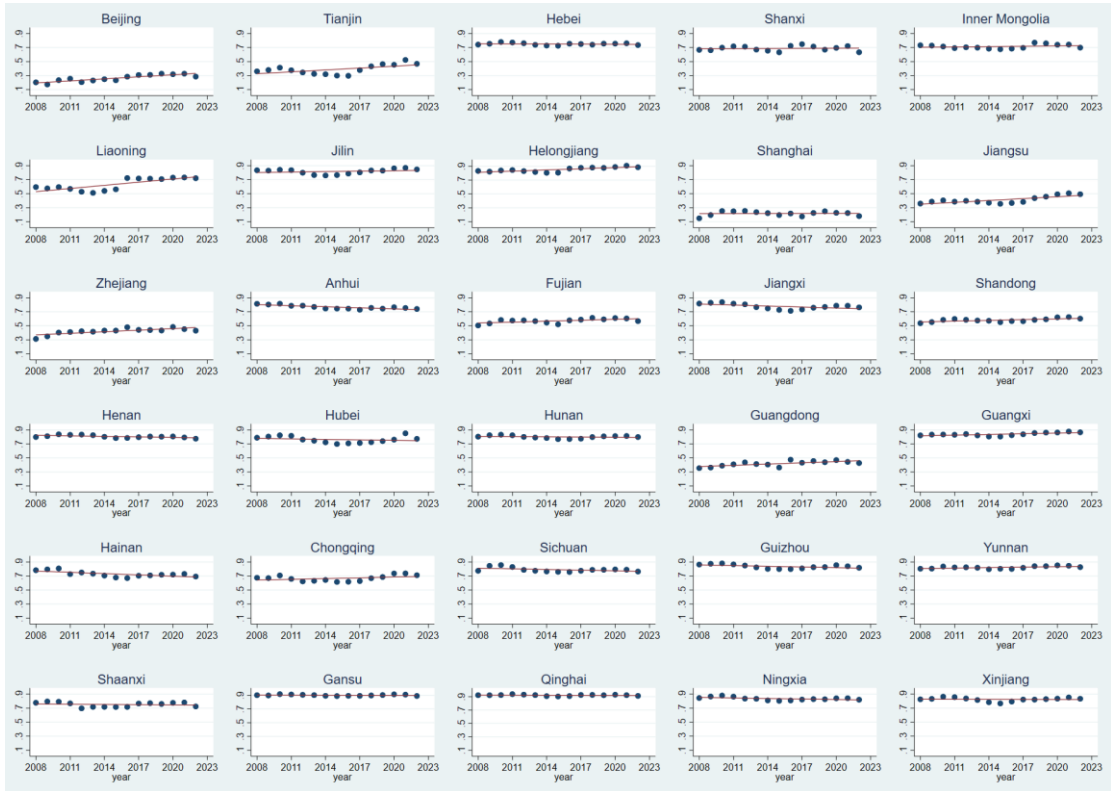


Figure 4.1: Measurement of VFI in 30 Provinces from 2008 to 2022

Sources: Data collected from China National Bureau of Statistics (2023), and VFI compiled by the author.

First, except for the provinces in the eastern region, for which it is relatively low, the vertical imbalance in 20 provinces exceeds the national average of 0.6855 in the past years. The gap between provinces is very large (Zhao et al., 2021), with an average standard deviation of 0.1518. The average imbalances in Shanghai and Beijing are only 0.2169 and 0.2633, respectively, whereas those for Gansu and Qinghai are each more than 0.9, and those for Jilin, Heilongjiang, Henan, Hunan, Guangxi, Guizhou, Yunnan, Ningxia, and Xinjiang are all more than 0.8. This study suggests that the reasons for the generally high degree of VFI are as follows: (i) the irrational division of financial and administrative powers among national and regional governments; (ii) the overly low levels of self-sufficiency of local finances; (iii) the lagging of the transfer payment system.

Second, the degree of VFI in each province is on an upward trend, but the magnitude of fluctuation is small. The national average shows a fluctuating upward trend, reaching 0.6896 in 2021. This is especially true in Beijing, Tianjin, Jiangsu, Guangdong and Zhejiang, economically developed eastern provinces and municipalities where the degree of VFI has a clear upward trend; on the other hand, the vast majority of central and western provinces fluctuate up and down near the average value and have always had a higher degree of imbalance (Zhang & Ma, 2022). This study suggests several possible reasons for this: first, because the VFI is already relatively high, there is only limited room for it to rise; second, higher VFI creates negative incentives for regional governments, and governments at all levels are trying to control the growth of this value.

Third, the vertical fiscal imbalance has obvious economic regional characteristics, as shown in Table 4.1: the overall level of the eastern region is less than that of the central region, which in turn is less than that of western region. For example, the average level of VFI in China's eastern, central and western regions, excluding Tibet, was 0.4900, 0.7838 and 0.8096, respectively, during 2008–2022, with the eastern region being significantly lower than the national average of 0.6855, while the central and western regions are higher. The difference between the eastern and central regions is 0.2939, and the difference between the eastern and western regions is 0.3196. At the same time, comparing the trend of VFI in the three major regions during the period 2008–2022 shows that the degree of VFI in the eastern region fluctuates and rises, exceeding 0.53 in 2020, then falling back to 0.51 in 2022. The central region generally rises and then declines, hovering around 0.8. The western region

sees a small decline in the middle years, but is above 0.8 in most years and has been on an upward trend since 2014. Obviously, compared to the eastern region, other regions have insufficient growth in fiscal revenues and expanding expenditure needs, so the VFI is bound to be higher (Song et al. 2021).

Table 4.1: Measures of Average VFI in China from 2008 to 2022

Year	Nation	East	Centre	West
2008	0.6735	0.4456	0.7947	0.8133
2009	0.6838	0.4598	0.7982	0.8247
2010	0.7061	0.4956	0.8156	0.8370
2011	0.6947	0.4845	0.8089	0.8219
2012	0.6814	0.4789	0.7915	0.8037
2013	0.6683	0.4667	0.7689	0.7967
2014	0.6576	0.4629	0.7531	0.7829
2015	0.6464	0.4472	0.7412	0.7766
2016	0.6710	0.4925	0.7625	0.7828
2017	0.6805	0.4949	0.7722	0.7993
2018	0.6977	0.5149	0.7836	0.8179
2019	0.6997	0.5218	0.7803	0.8190
2020	0.7134	0.5349	0.7974	0.8307
2021	0.7191	0.5394	0.8121	0.8312
2022	0.6896	0.5096	0.7769	0.8060
Average	0.6855	0.4900	0.7838	0.8096

Sources: Data collected from China National Bureau of Statistics (2023), and VFI compiled by the author.

The significantly lower VFI in the eastern provinces, as compared to the national average, is closely related to their tax base structure. The eastern region benefits from abundant tax sources in the manufacturing and service industries, resulting in a higher level of fiscal self-sufficiency and reduced reliance on central transfer payments (Zhao et al., 2021). In contrast, the VFI in the central and western provinces exceeds the national average, with a rising trend in the western region. This contradicts Song et al. (2021), who suggest

that the expansion of transfer payments automatically alleviates VFI. This discrepancy may stem from the fact that a substantial proportion of central transfer payments to the western region consists of earmarked funds, whose designated-use nature reinforces the downward shift of expenditure responsibilities, thereby exacerbating VFI. Moreover, the Western Development Strategy requires local governments to undertake non-economic responsibilities such as ecological protection and border security, which lack corresponding fiscal compensation (Cai & Chen, 2023).

4.2.2 Analysis of China's Quality of Economic Development

● Overall Level of Economic Development Quality in China

Using the definition and calculation method in Section 3.3.1, this study calculates the scores of Quality for 30 provinces for the period 2008–2022. The specific measurement results appear in Table 4.2:

Table 4.2: Quality Scores for 30 Provinces in China from 2008 to 2022

District	2008	2010	2012	2014	2016	2018	2020	2022	Region Average
Beijing	1.79*	2.16*	2.41*	2.52*	3.13*	4.18*	6.70*	7.58*	3.72*
Tianjin	-0.07	0.19*	0.47*	0.80*	1.35*	1.69*	2.27*	1.97*	1.08*
Hebei	-1.59 [#]	-1.36	-1.24 [#]	-0.98 [#]	-0.62 [#]	-0.27 [#]	0.26 [#]	0.18 [#]	-0.70 [#]
Shanxi	-1.30	-0.97	-0.96	-0.57	-0.19	-0.03	0.45	0.20 [#]	-0.41
Inner Mongolia	0.47	-1.00	-0.69	-0.47	-0.07	0.36	0.79	0.54	-0.08
Liaoning	-0.89	-0.68	-0.52	-0.17	0.15	0.60	1.06	0.84	0.05
Jilin	-1.05	-0.79	-0.67	-0.41	-0.08	0.31	0.73	0.68	-0.16
Heilongjiang	0.91	-1.22	-0.90	-0.72	-0.39	0.10	0.51	0.82	-0.24
Shanghai	4.84*	0.96*	1.39*	1.42*	1.71*	2.76*	3.85*	4.53*	2.43*
Jiangsu	-1.05	-0.73	-0.29	0.11*	0.46	0.76	1.53	1.94*	0.33
Zhejiang	-0.87	-0.53*	-0.23*	0.11*	0.49*	0.85	1.83*	1.93	0.43*
Anhui	-1.49	-1.28	-1.14	-0.79	-0.44	-0.02	0.46	0.70	-0.51

Table 4.2 continued

District	2008	2010	2012	2014	2016	2018	2020	2022	Region Average
Fujian	-1.31	-1.09	-0.89	-0.59	-0.29	-0.05	0.37	0.51	-0.43
Jiangxi	-1.64 [#]	-1.40	-1.30 [#]	-0.97 [#]	-0.61	-0.21	0.37	0.52	-0.67 [#]
Shandong	-1.37	-1.12	-0.86	-0.54	-0.30	0.14	0.74	0.77	-0.33
Henan	-1.75 [#]	-1.55 [#]	-1.39 [#]	-1.01 [#]	-0.69 [#]	-0.24 [#]	0.35	0.35	-0.75 [#]
Hubei	0.94 [*]	-1.26	-1.01	-0.79	-0.34	0.20	0.52	0.95	-0.25
Hunan	-1.50 [#]	-1.24	-1.09	-0.76	-0.38	0.04	0.47	0.56	-0.49
Guangdong	-0.69	-0.51 [*]	-0.34	-0.05	0.34	0.86 [*]	1.71 [*]	2.01 [*]	0.39
Guangxi	-1.72 [#]	-1.48 [#]	-1.35 [#]	-1.00 [#]	-0.74 [#]	-0.45 [#]	-0.19 [#]	-0.09 [#]	-0.88 [#]
Hainan	0.75	-1.23	-0.85	-0.65	-0.36	0.04	0.31	0.69	-0.29
Chongqing	1.15 [*]	-1.01	-0.69	-0.35	-0.04	0.43	1.29	1.04	0.10
Sichuan	0.74	-1.40 [#]	-1.12	-0.79	-0.45	-0.02	0.43	0.60	-0.39
Guizhou	0.21	-1.60 [#]	-1.29 [#]	-1.01 [#]	-0.69 [#]	-0.36 [#]	0.07 [#]	0.19 [#]	-0.67 [#]
Yunnan	0.19	-1.38	-1.10	-0.91	-0.67 [#]	-0.31 [#]	0.15 [#]	0.14 [#]	-0.57
Shanxi	0.51	-1.18	-0.89	-0.71	-0.39	0.08	0.48	0.49	-0.30
Gansu	0.47	-1.40 [#]	-1.14	-0.81	-0.45	0.07	0.39	0.46	-0.41
Qinghai	1.55 [*]	-0.71	-0.09 [*]	0.20 [*]	0.56 [*]	0.97 [*]	1.34	1.55	0.55 [*]
Ningxia	0.75	-1.21	-0.97	-0.66	-0.21	0.18	0.37	0.44	-0.29
Xinjiang	0.39	-1.02	-0.79	-0.58	-0.32	0.09	0.24 [#]	0.44	-0.26
Nation Average	-1.11	-0.83	-0.65	-0.35	0.02	0.40	0.98	1.00	-0.07

Sources: ①Original data from China National Bureau of Statistics (2023), then calculated by the author according to the formula in 3.3.1. ②* and # denote the top five and bottom five rankings of Quality level score of that year, respectively.

The measurement results in Table 4.2 show the standard deviation of the composite score of Quality in 30 provinces from 2008 to 2022 is 1.24. Beijing has the highest yearly average level at 3.72, which exceeds the national average. The lowest value is -0.88 for Guangxi Province, which is lower than the national average. Twenty-one provinces have negative average composite scores over the years, accounting for 70% of the total, and only 9 provinces exceed the average, which shows that there are large spatial gaps in China's Quality.

In 2008, nine provinces, Hebei, Shanxi, Anhui, Fujian, Jiangxi, Shandong, Henan, Hunan and Guangxi, are below the national average score of -1.11. The highest-scoring, Shanghai, is 4.84 higher than the lowest-scoring, Guangxi, which may be attributed to the severe subprime mortgage crisis in 2008, which hit the economically weaker provinces harder and led to excessive inter-provincial disparities. This suggests that China's inter-provincial economic development gap is widening, that China's strategy of coordinated regional development has not yet yielded results, and that there is a long way to go to achieve coordinated inter-regional development.

● Quality of Economic Development in the Three Regions

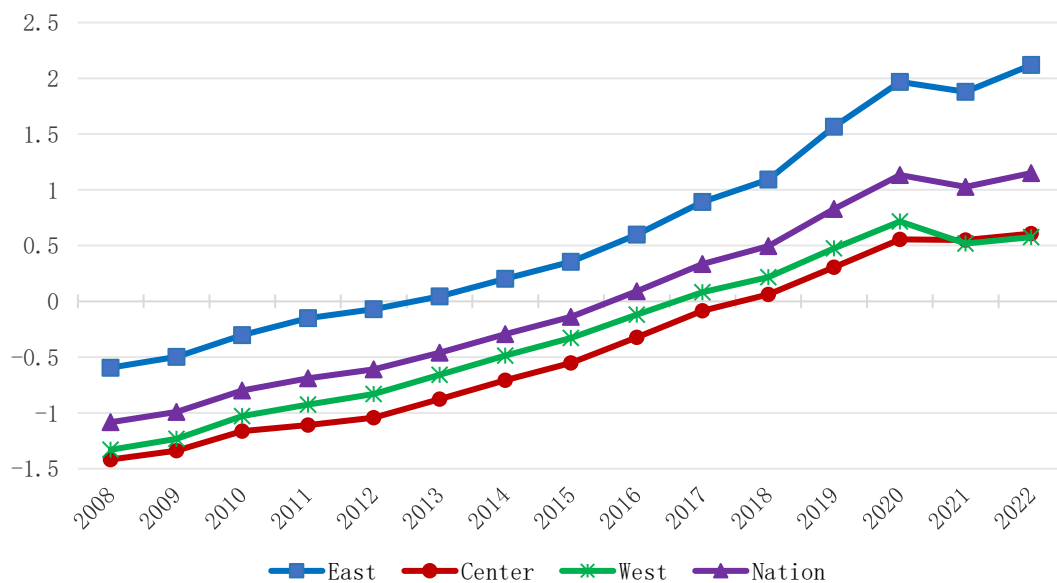


Figure 4.2: Time Evolution of Quality Scores for the Three Regions

Sources: Data collected from China National Bureau of Statistics (2023), and regional data calculated by the author.

After dividing the country into three regions to calculate the scores, as shown in Figure 4.2, the scores of Quality in each region, as measured by the five development

concepts, showed a continuous upward trend until 2020, then declined for the first time in 2021, which confirms that the high-speed growth stage of the economy experienced by China before has indeed produced a series of problems and affected Quality. The five development concepts are very consistent with China's national conditions and economic development, and all provinces have actively responded to the national policy and insisted on the implementation of the new development concepts, which have achieved certain results.

Therefore, an in-depth exploration and study of the new development concept is very necessary to improve Quality. It is clear that the eastern region has the best Quality, much higher than that in the western and central regions. Before 2021, Quality in the central region was lower than that in the western region, and after 2021, it was almost equal.

Table 4.3: GDP Values for Three Regions in China from 2008 to 2022

Year	East	Centre	West
2008	1.4505	0.7928	0.4305
2009	1.6040	0.8895	0.4834
2010	1.7683	0.9934	0.5454
2011	1.9740	1.1240	0.6200
2012	2.0929	1.2623	0.7061
2013	2.2833	1.3939	0.7889
2014	2.4875	1.5261	0.8732
2015	2.6832	1.6549	0.9520
2016	2.8854	1.7831	1.0335
2017	3.0869	1.9184	1.1178
2018	3.3037	2.0655	1.2031
2019	3.5232	2.2170	1.2904
2020	3.7382	2.3659	1.3767
2021	3.8443	2.3971	1.4213
2022	4.1584	2.5942	1.5287
Average	2.7256	1.6652	0.9581

Sources: GDP data collected from China National Bureau of Statistics (2023), and regional data calculated by the author.

From the values in Table 4.3, the mean GDPs for the eastern, central and western regions from 2008–2022 are 2.7256 billion yuan, 1.6652 billion yuan and 0.9581 billion yuan, respectively. Compared with the central region, although the average GDP level of the western region is lower by 42.47%, the index of Quality is higher by 33.33%. Obviously, the amount of GDP is no longer an important factor in measuring Quality, and balanced development in all aspects is the main theme of China’s Quality in the new era.

Compared with the eastern region, meanwhile, the average GDP level of the central region is lower by 38.90%, while the level of Quality is lower by 39.79%. There is no clear difference between the GDP levels and the indexes of Quality in the central and eastern regions, which suggests that the development strategy of the central region is relatively reasonable.

In addition, the scores for each aspect of the indicators for the three regions appear in Table 4.4.

Table 4.4: Indicator Scores by Dimension for the Three Regions

District	Innovation			Coherence			Greenness		
	2016	2022	Trends	2016	2022	Trends	2016	2022	Trends
East	1.0255	2.9264	171.33%	1.2491	1.9045	61.62%	0.0927	1.2764	2065.75%
Centre	-0.5675	0.3738	177.83%	-0.5838	0.2825	156.56%	-0.1063	-0.0450	48.84%
West	-0.7391	-0.3009	47.98%	-0.1700	0.2191	203.01%	-0.4373	-0.4282	0.23%
District	Openness			Sharing			Overall Score		
	2016	2022	Trends	2016	2022	Trends	2016	2022	Trends
East	0.9782	0.7164	-35.04%	-0.2782	0.8673	671.77%	0.5995	2.1200	253.87%
Centre	-0.8275	-0.7475	8.45%	-0.1063	1.1688	1556.58%	-0.3225	0.6075	288.37%
West	-0.75	-0.7936	-28.09%	0.5455	1.8818	418.71%	-0.1191	0.5764	583.97%

Sources: Original data from China National Bureau of Statistics (2023), then calculated by the author according to the formula in 3.3.1.

Overall, following the introduction of the five development concepts, the comprehensive scores of various regions significantly increased from 2016 to 2022. The eastern and central regions saw improvements of 253.87% and 288.37%, respectively, while the western region experienced the most substantial growth at 583.97%. Specifically, the outcomes are as follows:

In terms of innovative development, the eastern region scored significantly higher than the other two regions, with all three regions showing an upward trend. The central region saw the largest increase at 177.83%, followed by the eastern and western regions with increases of 171.33% and 47.98%, respectively.

In terms of coordinated development, all three regions—eastern, central, and western—experienced substantial growth, with the central and western regions seeing increases of 156.56% and 203.01%, respectively.

In terms of green development, the eastern region exhibited a remarkable growth rate of 2065.75%. In 2016, the central and western regions had similar scores, but by 2022, the gap had widened, with the central region seeing a significant increase of 48.84%, while the western region remained almost unchanged, with only a very minor decline of 0.23%.

In terms of open development, the eastern region maintained a score much higher than the other two regions, though its growth rate declined by 35.04%. The central and western regions both recorded negative scores, with the central region increasing by 8.45% and the western region declining by 28.09%.

In terms of sharing, all three regions demonstrated significant upward trends, with the central region showing particularly notable growth at 1556.58%, and the eastern and western regions increasing by 671.77% and 418.71%, respectively.

- Analysis of Secondary Indicators of Economic Development Quality

Due to space limitations, Table 4.5 only lists the scores for each province in 2022 for the secondary indicators. In terms of innovation development, the distribution of scores ranges from a low of 0.08 (Xinjiang) to a high of 1.34 (Beijing); the latter is 16.75 times higher than the former, with an overall variance of 0.11. Guangdong, which is ranked second, is only 23.13% lower than Beijing, making the gap between China's inter-provincial innovation development very obvious. A mere 10 provinces, namely Beijing, Guangdong, Jiangsu, Shanghai, Zhejiang, Tianjin, Shandong, Anhui, Fujian and Hubei, all of which have scores above the average of 0.36, account for 33.33% of the total, and seven provinces have scored no higher than 0.1. This shows that China still needs to focus on the development of innovation, especially in the last four provinces, where there is plenty of space for growth.

In terms of coordinated development, the distribution of scores ranges from -0.19 (Henan) to 1.86 (Zhejiang). Fifteen provinces, accounting for 50%, had scores above the average of 0.92. The top seven provinces are Zhejiang, Beijing, Shanghai, Tianjin, Guangdong, Liaoning, and Hainan, all in the eastern region, while the bottom seven provinces are Henan, Hunan, Jiangxi, Anhui, and Hubei, all in the central region. The western region is in the middle of the rankings, with an upward trend in coordination scores.

The central region is more economically developed, and inevitably there are structural imbalances that can be adjusted in the industrial, urban and rural, investment and consumption, and financial structures. A number of provinces in the eastern region, with a steady upward trend in coordination scores, have made the greatest contribution to Quality.

In terms of green development, the distribution of scores ranges from 0.02 (Ningxia, Guizhou, Guangxi) to 1.14 (Beijing); the latter is 57 times higher than the former, with a standard deviation of 0.22. The second-ranked Shanghai is only 64.04% higher than Beijing, which makes the gap in China's inter-provincial green development very obvious. There are only eight provinces with scores above the mean value of 0.15, indicating that many provinces still need to improve their green development. The top four provinces are Beijing, Shanghai, Tianjin and Jiangsu, all in the eastern part of the country, while the provinces at the back of the ranking are Ningxia, Guizhou, Guangxi, Xinjiang, Qinghai and Yunnan, all in the western region, with scores much lower than the mean value. The construction of ecological civilization in the western part of the country needs to be further strengthened.

In terms of open development, the distribution of scores ranges from 0 (Qinghai) to 0.58 (Shanghai), with a standard deviation of 0.153. Twenty provinces scored below the average of 0.159, accounting for 66.67% of the total, whereas the top three provinces had scores of 0.58 (Shanghai), 0.51 (Guangdong), and 0.47 (Zhejiang), with a very large gap between the provinces. On the whole, China's degree of open is still relatively low.

In terms of shared development, the distribution of scores ranges from a low of 0.34 (Guangdong) to 1.4 (Qinghai); the latter is 4.12 times higher than the former, with a standard deviation of 0.201. Fourteen provinces, accounting for 46.67%, have scores below the mean of 0.704. The top five provinces are Qinghai, Heilongjiang, Inner Mongolia, Beijing and Xinjiang, followed by Guangdong, Fujian, Zhejiang, Hebei and Guangxi. Nine provinces in the eastern region ranked in the bottom 20, indicating that eastern region needs to improve its sharing development.

Table 4.5: China's 30 Provincial Secondary Indicator Scores in 2022

District	Innovations		Coherence		Green		Open		Share	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Beijing	1.34	1	1.64	2	1.14	1	0.36	4	0.9	4
Tianjin	0.54	6	1.21	4	0.23	3	0.34	5	0.56	22
Hebei	0.16	20	0.75	13	0.06	21	0.08	17	0.49	27
Shanxi	0.15	21	0.67	17	0.05	22	0.06	20	0.63	20
Inner Mongolia	0.09	27	0.6	22	0.04	24	0.03	26	0.92	3
Liaoning	0.19	18	0.93	6	0.07	19	0.16	10	0.78	9
Jilin	0.13	23	0.82	8	0.1	15	0.05	25	0.78	10
Heilongjiang	0.1	24	0.8	11	0.13	9	0.06	21	0.97	2
Shanghai	0.91	4	1.5	3	0.73	2	0.58	1	0.83	6
Jiangsu	0.93	3	0.82	9	0.2	4	0.32	6	0.56	23
Zhejiang	0.85	5	1.86	1	0.15	7	0.47	3	0.46	28
Anhui	0.44	8	0.22	26	0.11	12	0.1	14	0.59	21
Fujian	0.42	9	0.18	28	0.11	13	0.25	7	0.39	29
Jiangxi	0.29	11	0.2	27	0.07	20	0.11	12	0.65	19
Shandong	0.45	7	0.45	24	0.12	11	0.24	8	0.52	25
Henan	0.25	15	-0.19	30	0.16	6	0.08	18	0.56	24
Hubei	0.4	10	0.36	25	0.13	10	0.06	22	0.74	12
Hunan	0.26	13	0.04	29	0.15	8	0.08	19	0.7	17
Guangdong	1.03	2	1.75	5	0.09	16	0.51	2	0.34	30
Guangxi	0.1	25	0.62	20	0.02	28	0.14	11	0.52	26
Hainan	0.18	19	0.83	7	0.08	18	0.1	15	0.67	18
Chongqing	0.27	12	0.82	10	0.18	5	0.19	9	0.82	7
Sichuan	0.26	14	0.7	16	0.11	14	0.11	13	0.78	11

Table 4.5 continued

District	Innovations		Coherence		Green		Open		Share	
	Score	Rank	Score	Rank	Score		Score	Rank	Score	Rank
Guizhou	0.14	22	0.66	19	0.02	29	0.02	28	0.73	14
Yunnan	0.1	26	0.57	23	0.04	25	0.06	23	0.74	13
Shanxi	0.24	16	0.67	18	0.09	17	0.09	16	0.71	16
Gansu	0.09	28	0.75	14	0.05	23	0.02	29	0.79	8
Qinghai	0.09	29	0.76	12	0.03	26	0	30	1.4	1
Ningxia	0.22	17	0.72	15	0.02	30	0.03	27	0.72	15
Xinjiang	0.08	30	0.62	21	0.03	27	0.06	24	0.87	5

Sources: Original data from China National Bureau of Statistics (2023), then calculated by the author according to the formula in 3.3.1.

A year-by-year analysis of the rankings of Quality across provinces reveals that only Beijing has consistently remained among the top five. Other eastern provinces—such as Shanghai, Guangdong, Zhejiang, Jiangsu, and Tianjin—have also frequently ranked among the top performers, albeit with relatively minor fluctuations. This indicates that these provinces benefit from sustained advantages in innovation capacity, industrial upgrading, and international openness, all critical drivers of high-quality development (Zhang & Ma, 2022).

In contrast, provinces located in western China—such as Xinjiang, Gansu, and Qinghai—have consistently appeared among the bottom five. These regions generally score below the national average across all dimensions, with particularly low scores in openness. For instance, in 2022, the openness indexes for Xinjiang, Gansu, and Qinghai were 62.18%, 87.39%, and 100% below the national average, respectively. This suggests that the expected improvements in openness under the central government’s Western Development Strategy

have not been fully realized. Cai and Chen (2023) argue that the limited integration of these regions into global trade networks continues to hinder their industrial modernization.

Gansu Province, in particular, faces dual constraints of weak innovation and low openness. In 2022, its innovation score accounted for only 25.23% of the national average, making its Quality especially susceptible to external shocks. Similarly, several other provinces—including Fujian, Inner Mongolia, Jiangxi, Hunan, Guangxi, Guizhou, Yunnan, and Ningxia—have occasionally fallen into the bottom five, reflecting underlying structural weaknesses and insufficient resilience.

Compared to the eastern region, western provinces lag behind in attracting foreign direct investment, participating in international trade, and establishing cross-border technological collaborations. This highlights a key bottleneck in their pursuit of high-quality development. Therefore, policy efforts in the western region should not only address fiscal and infrastructure deficits but also prioritize improvements in openness—such as optimizing the business environment, strengthening global industrial linkages, and increasing cooperation under the Belt and Road Initiative (Wang & Liu, 2021). These measures can help mitigate the constraints posed by limited openness and enhance the resilience and sustainability of regional economic development.

4.2.3 Analysis of Tax Effort

The specific selection of indexes and measurement methodology appears in Figure 3.4.1. Efforts to measure the results of this study are plotted over time for each province and sub-region, as shown in Figures 4.3 and 4.4.

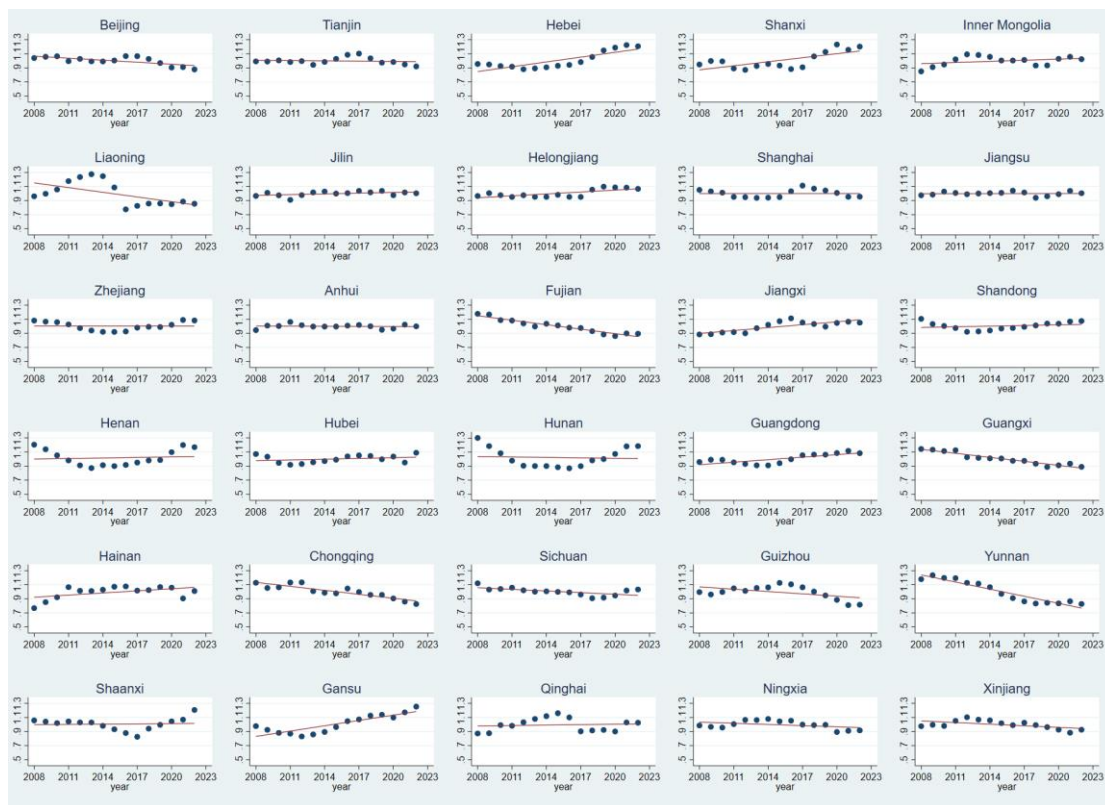


Figure 4.3: Changes of Local Government Tax Effort from 2008 to 2022

Sources: Data collected from China National Bureau of Statistics (2023), and Tax Effort compiled by the author.

First, the change in local government tax effort over time varies across provinces and does not show any relatively consistent pattern of change. Eight provinces show an upward trend in tax effort, namely Hebei, Shanxi, Heilongjiang, Jiangxi, Guangdong, Hainan, Shanxi, and Gansu. On the other hand, the following fourteen provinces have almost flat levels of tax effort from 2008 to 2022: Tianjin, Inner Mongolia, Jilin, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Henan, Hubei, Hunan, Guangxi, Yunnan, Shaanxi, Qinghai, Ningxia, and Xinjiang.

Zhejiang, Anhui, Shandong, Henan, Hubei, Hunan, Qinghai, Ningxia, and Xinjiang. Finally, eight provinces, Beijing, Liaoning, Fujian, Guangxi, Chongqing, Sichuan, Guizhou, and Yunnan, are experiencing a downward trend.

Second, the absolute value of local governments' tax effort shows a stage-by-stage characteristic. During periods of rapid economic growth, governments are more likely to strengthen tax collection and administration to meet funding needs for infrastructure development and public services. In contrast, when economic growth slows or structural adjustments are required, governments may adopt tax reduction and fee-cutting policies to stimulate market vitality and encourage enterprise investment.

The Teffort level of the western region is close to the national average from 2008 to 2010; that of the central region is higher than the average and shows a downward trend; and that of the eastern region is lower than the national average and shows an upward trend. Moreover, the tax effort level of the eastern region rises to the national average from 2010–2017; that of the western region is higher than the national average; and that of the central region falls below the average. From 2017 to 2022, the absolute values of local governments' tax effort show a significant trend: the figure for the western region is below the national average, which is itself below that of the eastern region, which in turn is below that of the central region. Specifically, the average annual tax effort levels of the central, eastern, and western regions, and of the whole country are 1.0088, 1.0058, 1.0005 and 1.0021, respectively.

These trends can be interpreted within the broader framework of China's economic and fiscal policies. In the eastern region, intensified market competition and the pressures of an export-oriented economy have prompted local governments to adopt tax reductions as a strategy to attract investment (Tian & Wang, 2023). This aligns with studies on tax competition among Chinese provinces, where fiscal incentives commonly serve to facilitate industrial relocation and attract foreign direct investment (Tang & Ye, 2020). However, this approach may create a trade-off between short-term investment attractiveness and long-term fiscal sustainability.

The central region, benefiting from its economic strength and strategic location, has actively mobilized fiscal resources, maintaining a consistently high level of tax effort. In contrast, the western region faces structural constraints such as low industrialization levels and low factor returns, making it challenging to attract external capital and labour (Lu & Wu, 2019). As a result, tax incentives may not effectively stimulate investment, and excessive tax reductions could further erode fiscal revenues. Instead, strengthening tax collection and administration emerges as a more viable strategy to ensure stable fiscal revenues.

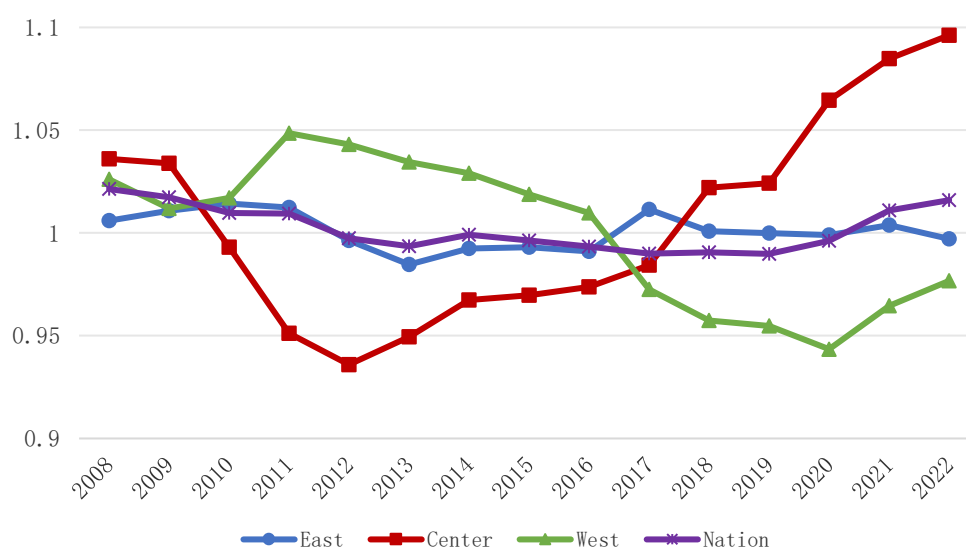


Figure 4.4: Trends of Local Government Tax Effort from 2008 to 2022

Sources: Original data from China National Bureau of Statistics (2023), and Tax Effort compiled by the author.

4.2.4 Analysis of Expenditure Structure

Due to the lack of data about Tibet and the implementation of the new government revenue and expenditure classification standard and statistical calibre in China in 2007, the public expenditure structure of 30 provinces (except Tibet) in 2008–2022 is measured according to the connotation and calculation method in Section 3.4.3 of this study. The specific results of the measurement are shown in Table 4.6.

First, as a whole, the public expenditure structure of China's provinces, with some exceptions, largely centres between 0.5 and 0.7, with an overall standard deviation of only 0.018, and inter-provincial differences are not obvious. The top-ranked provinces in terms of local government general public budget expenditures for livelihood-related expenditures include Henan, Guangdong, Hubei, Guangxi, Hunan, Hebei, Shanxi, etc.; the bottom-ranked provinces include Shanghai, Ningxia, Tianjin, Inner Mongolia, Qinghai, and Chongqing.

Second, the structure of public expenditure fluctuates widely, with significant inter-provincial differences. As Table 4.6 shows, the expenditure structures of Qinghai Province in 2008 and 2022 are 0.6695 and 0.5695, respectively. Thus, this province's proportion of expenditure on livelihoods in 2022 was 14.94% lower than it had been in 2008. Other provinces with decreases in livelihood expenditure include Shanxi, Hainan, Ningxia, Inner Mongolia, Gansu, and Xinjiang, with decreases of 12.60%, 12.24%, 8.85%, 8.49%, 7.60%, and 7.59%, respectively. In contrast, the public expenditure structures of Guangdong, Tianjin, Jiangsu, Beijing, Shandong, Chongqing, and Shanghai saw fairly large increases of 10.27%, 6.25%, 5.65%, 5.30%, 4.48%, 4.28% and 3.26%, respectively, and there was a small increase of about 0.37% in Liaoning province.

Table 4.6: Gstructure of 30 Provinces in China from 2008 to 2022

District	2008	2010	2012	2014	2016	2018	2020	2022	Average
Beijing	0.6177 [#]	0.5783	0.5871	0.5792	0.5451	0.5668	0.6067	0.6505	0.5928
Tianjin	0.5742 [#]	0.5173 [#]	0.4955 [#]	0.4875 [#]	0.4866 [#]	0.5272 [#]	0.5334 [#]	0.6101	0.5288
Hebei	0.6625	0.6362 [*]	0.6285 [*]	0.6286	0.6082	0.6336	0.6190	0.6280	0.6295
Shanxi	0.7043 [*]	0.6459 [*]	0.6113	0.6032	0.6087	0.6333	0.5753	0.6156	0.6191
Inner Mongolia	0.5925 [#]	0.5599	0.5376 [#]	0.5281 [#]	0.5192 [#]	0.5526 [#]	0.5085 [#]	0.5422 [#]	0.5405
Liaoning	0.6706	0.6133	0.5933	0.5456	0.6237 [*]	0.6725 [*]	0.6424 [*]	0.6731 [*]	0.6278
Jilin	0.6531	0.6111	0.5916 [#]	0.5872	0.5757	0.5611	0.5670	0.6212	0.5920
Heilongjiang	0.6402	0.6037	0.5711	0.5812	0.5682	0.5746	0.5590	0.6286	0.5893
Shanghai	0.5099 [#]	0.4865 [#]	0.5029	0.5081 [#]	0.4274 [#]	0.5156 [#]	0.5025 [#]	0.5265 [#]	0.5005
Jiangsu	0.6213	0.5540 [#]	0.5615	0.5770	0.5589	0.6145	0.6318 [*]	0.6564	0.5956
Zhejiang	0.6795 [*]	0.6134	0.6172 [*]	0.6266	0.5804	0.6324	0.6134	0.6505	0.6286
Anhui	0.6396	0.5812	0.6084	0.6161	0.5999	0.6046	0.6137	0.6365	0.6110
Fujian	0.6635	0.6097	0.5805	0.5626	0.5565	0.5650	0.6056	0.6494	0.6006
Jiangxi	0.6567	0.5810	0.5897	0.6064	0.6104	0.6213	0.6142	0.6095	0.6107
Shandong	0.6514	0.6017	0.6139	0.6074	0.6013	0.6397 [*]	0.6464 [*]	0.6806 [*]	0.6290
Henan	0.6843 [*]	0.6447 [*]	0.6560 [*]	0.6703 [*]	0.6415 [*]	0.6379	0.6368 [*]	0.6682 [*]	0.6558
Hubei	0.6803 [*]	0.6255	0.6105	0.6095	0.5946	0.6578 [*]	0.6191	0.6589 [*]	0.6353
Hunan	0.6649	0.6341 [*]	0.6069	0.6260	0.6223 [*]	0.6299	0.6085	0.6280	0.6299

Table 4.6 continued

District	2008	2010	2012	2014	2016	2018	2020	2022	Average
Guangdong	0.6446	0.6450*	0.6121	0.6421*	0.5456	0.6482*	0.6775*	0.7108*	0.6445
Guangxi	0.6707*	0.6219	0.6186*	0.6385*	0.6353*	0.6345	0.6133	0.6432	0.6339
Hainan	0.6525	0.5929	0.6007	0.6058	0.6122	0.5796	0.5761	0.5726 [#]	0.5982
Chongqing	0.6264	0.5919	0.5308 [#]	0.5341	0.5464	0.5637	0.5914	0.6531	0.5777
Sichuan	0.6592	0.4944 [#]	0.5987	0.5991	0.6092	0.6396	0.6278	0.6515	0.5989
Guizhou	0.6509	0.6028	0.5993	0.6437*	0.6440*	0.6448*	0.5745	0.6271	0.6263
Yunnan	0.6542	0.6078	0.6073	0.5888	0.5922	0.6279	0.5955	0.6277	0.6153
Shan'xi	0.6484	0.6199	0.6150*	0.6391*	0.6205	0.6258	0.6039	0.6336	0.6295
Gansu	0.6568	0.5912	0.6146	0.6290	0.6035	0.6133	0.5901	0.6069	0.6099
Qinghai	0.6695	0.5953	0.5849	0.4832 [#]	0.4873 [#]	0.5574 [#]	0.5237 [#]	0.5695 [#]	0.5619
Ningxia	0.6168 [#]	0.5057 [#]	0.5083 [#]	0.5020 [#]	0.5197 [#]	0.5029 [#]	0.5166 [#]	0.5623 [#]	0.5261
Xinjiang	0.6522	0.6199	0.5996	0.5888	0.5814	0.6217	0.5987	0.6027	0.6056

Sources: ①Original data from China National Bureau of Statistics (2023), then calculated by the author according to the formula in 3.4.2. ②* and # denote the top five and bottom five rankings of Quality level score of that year, respectively.

Third, we calculate the average level of public expenditure structure in the three regions based on Table 4.6 and the results appear in Table 4.7 and Figure 4.5.

Table 4.7: Average Gstructure in the Three Regions from 2008 to 2022

Year	East	Centre	West	Nation
2008	0.6316	0.6654	0.6452	0.6456
2009	0.6188	0.6413	0.6124	0.6225
2010	0.5862	0.6159	0.5828	0.5929
2011	0.5826	0.5981	0.5879	0.5887
2012	0.5812	0.6057	0.5832	0.5884
2013	0.5949	0.6294	0.5923	0.6032
2014	0.5791	0.6125	0.5795	0.5882
2015	0.5767	0.6059	0.5738	0.5834
2016	0.5587	0.6027	0.5781	0.5775
2017	0.5843	0.6116	0.5913	0.5941
2018	0.5996	0.6151	0.5986	0.6033
2019	0.6036	0.6154	0.5933	0.6029
2020	0.6050	0.5992	0.5767	0.5931
2021	0.6277	0.6167	0.5927	0.6119
2022	0.6371	0.6333	0.6109	0.6265

Sources: Data from China National Bureau of Statistics (2023), and calculated on the basis of the formula in 3.4.2.

In terms of trends, the level of the public expenditure structure generally shows a fluctuating trend of falling and then rising. The structure of public expenditure experienced a relatively large drop in successive years from 2008 to 2011, a fluctuating downward trend from 2011 to 2016, and a fluctuating upward trend from 2016 to 2022, suggesting that the introduction of the new development concept has markedly improved people's levels of livelihood in China. Second, in terms of total volume, there is a relatively small gap between the structural levels of public expenditure in the three regions. The central region has a higher level of public expenditure structure, above the national average of 2.73%. The public expenditure structure in the eastern region is slightly lower than the national average until 2019, then slightly higher after 2019. The western region has the lowest level of public expenditure structure, 1.37% below the average. Finally, compared to 2008, although the eastern region shows a small increase in 2022, the central and western regions show varying degrees of decline, with a 4.82% decrease in the central region and an 8.06% decrease in the western region.

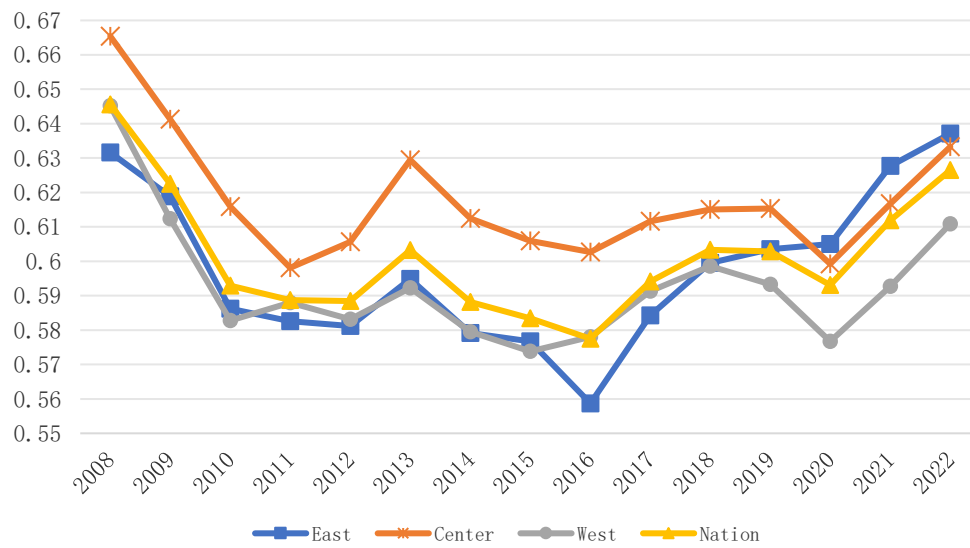


Figure 4.5: Average Level of Gstructure by Regions from 2008 to 2022

Sources: Original data from China National Bureau of Statistics (2023), and Gstructure compiled by the author.

The observed trends in public expenditure structure align with China's broader fiscal policy framework. Liu et al. (2023) emphasized that intensified market competition and export-oriented growth in the eastern region have driven local governments to adopt tax incentives to attract investment. This finding is consistent with our results, which show that the public expenditure structure in eastern provinces has increased, driven by improvements in the revenue base. Furthermore, regional differences in public expenditure reflect broader economic and institutional disparities. The central region, benefiting from its strategic location and economic strength, has maintained a relatively high level of public expenditure, consistent with the findings of Chu & Shao (2018). In contrast, the western region faces challenges related to industrialization and labour market constraints, limiting its ability to effectively utilize tax incentives to attract investment.

4.3 Discussion on Test Results

Based on the identification conditions in 3.9.6 for the system of simultaneous equations, we identify the order and rank conditions for each equation in the system. The identification process and results are shown in Table 4.8.

Table 4.8: Identification of the Simultaneous Equations System

Equations	Endogenous Variables g_i	Exogenous variables k_i	$k-k_i$	g_i-1	Type of identification
3.21	3	5	8	2	Over-identified
3.22	1	8	5	0	Over-identified
3.23	1	7	6	0	Over-identified

The summary of the above table indicates that each equation in the system of simultaneous equations satisfies both the order condition and the rank condition. Therefore, the entire system of simultaneous equations is identifiable.

4.3.1 Stationarity Tests

To avoid spurious regression and ensure the validity of regression results, this study conducts stationarity tests on the data before performing regression analysis. This study employs the LLC test and the Fisher-ADF test, using Stata 17.0 software to test for unit roots in each variable. As shown in Table 4.9, all variables are significant at the 5% significance level, thereby rejecting the null hypothesis of the presence of a unit root. This indicates that all variables have passed the stationarity test and can achieve a stationary state without requiring differencing (Keshab, 2019; Zhang & Wang, 2020). Consequently, the 3SLS estimation can proceed.

Table 4.9: Panel Unit Root Test Results

Variables	LLC	Fisher-ADF				Conclusion
		P	Z	L*	Pm	
Quality	$-1.4 \times 10^{13}***$ (0.0000)	90.8665*** (0.0062)	-1.8364** (0.0332)	-1.9276** (0.0279)	2.8177*** (0.0024)	I (0)
VFI	$-1.5 \times 10^{13}***$ (0.0000)	133.9130*** (0.0000)	-6.2351*** (0.0000)	-6.1312*** (0.0000)	6.7473*** (0.0000)	I (0)
Ind	$-2.5 \times 10^{13}***$ (0.0000)	141.2966*** (0.0000)	-5.7091*** (0.0000)	-5.9491*** (0.0000)	7.4213*** (0.0000)	I (0)
Transfer	$-2.9 \times 10^{14}***$ (0.0000)	90.3639*** (0.0068)	-1.7811** (0.0374)	-1.6725** (0.0482)	2.7718*** (0.0028)	I (0)
Open	$-1.5 \times 10^{13}***$ (0.0000)	162.4680*** (0.0000)	-7.4742*** (0.0000)	-7.6513*** (0.0000)	9.3540*** (0.0000)	I (0)
Compete	$-4.9 \times 10^{13}***$ (0.0000)	355.7075*** (0.0000)	- 14.3859*** (0.0000)	- 17.9064*** (0.0000)	26.9943*** (0.0000)	I (0)
Teffort	$-1.1 \times 10^{14}***$ (0.0000)	144.2382*** (0.0000)	-6.6799*** (0.0000)	-6.6238*** (0.0000)	7.6899*** (0.0000)	I (0)
Gstructure	$-2.8 \times 10^{13}***$ (0.0000)	157.3603*** (0.0000)	-6.5666*** (0.0000)	-6.8503*** (0.0000)	8.8877*** (0.0000)	I (0)
Fss	$-8.6 \times 10^{12}***$ (0.0000)	130.2150*** (0.0000)	-5.7899*** (0.0000)	-5.7842*** (0.0000)	6.4097*** (0.0000)	I (0)
Urban	$-2.2 \times 10^{13}***$ (0.0000)	127.2231*** (0.0000)	-5.2875*** (0.0000)	-5.4035*** (0.0000)	6.1366*** (0.0000)	I (0)
Gscale	$-2.3 \times 10^{13}***$ (0.0000)	143.8969*** (0.0000)	-6.5846*** (0.0000)	-6.6245*** (0.0000)	7.6587*** (0.0000)	I (0)
Density	$-2.5 \times 10^{12}***$ (0.0000)	233.4761*** (0.0000)	-9.2920*** (0.0000)	- 11.0776*** (0.0000)	15.8361*** (0.0000)	I (0)
Ptax	$-1.6 \times 10^{13}***$ (0.0000)	153.9028*** (0.0000)	-7.1718*** (0.0000)	-7.2018*** (0.0000)	8.5721*** (0.0000)	I (0)
Pgdp	$-1.6 \times 10^{13}***$ (0.0000)	175.8631*** (0.0000)	-8.2587*** (0.0000)	-8.4671*** (0.0000)	10.5768*** (0.0000)	I (0)
Capital	$-3.3 \times 10^{13}***$ (0.0000)	155.5875*** (0.0000)	-6.3643*** (0.0000)	-6.5342*** (0.0000)	8.7259*** (0.0000)	I (0)

Note: ① LLC refers to Levin, Lin, and Chu (LLC, 2002) panel unit root test, while P, Z, L* and Pm of the Fisher-ADF test refer to inverse Chi-squared (χ^2), inverse standard normality, inverse logit and modified inversed χ^2 statistics respectively. ② Numbers in parentheses are p-values; ③ *** and ** denote the rejection of the null hypothesis at 1% and 5% significance levels, respectively, and I(n) denotes that the series is smooth after nth-order differencing. ④ The data in this table were computed by Stata 17.0.

4.3.2 Other Tests

Based on the aforementioned tests in 3.9 and 3.10, the results of the mixed regression, random effects, and fixed effects models, as well as the tests for multicollinearity, heteroskedasticity, serial correlation and Durbin-Wu-Hausman test, are summarized in Tables 4.10, Table 4.11, and Table 4.12.

Table 4.10: Test Results of Dependent Variable: Quality-Eq (3.21)

Variables	Quality		
	Pooled OLS	Random Effect	Fixed Effect
Breusch-Pagan LM Test	362.77 (0.0000) ***		—
Robust Hausman Test	—	158.526 (0.0000) ***	
Observations	450	450	450
Multicollinearity(vif)			4.60
Heteroskedasticity (χ^2 -stat)	—	—	1361.30 (0.0000) ***
Serial Correlation (F-stat)	—	—	109.815 (0.0000) ***
Durbin-Wu-Hausman Test	217.744 (0.0000) ***		

Note:①Figures in the parentheses are p-values.②*** indicates significance at the 1% significance levels; standard errors corresponding to estimated coefficients are in parentheses for each variable.

Table 4.11: Test Results of Dependent Variable: Teffort-Eq (3.22)

Variables	Teffort		
	Pooled OLS	Random Effect	Fixed Effect
Breusch-Pagan LM test	455.82 (0.0000)		—
Hausman test	—	80.763 (0.0000) ***	
Observations	450	450	450
Multicollinearity(vif)	—	—	7.33
Heteroskedasticity (χ^2 -stat)	—	—	302.21 (0.0000) ***

Table 4.11 continued

Variables	Teffort		
	Pooled OLS	Random Effect	Fixed Effect
Serial Correlation (F-stat)	—	—	362.351 (0.0000) ***
Durbin-Wu-Hausman Test	7.607 (0.0058) ***		

Note: ①Figures in the parentheses are p-values. ②*** indicates significance at the 1% significance levels; standard errors corresponding to estimated coefficients are in parentheses for each variable.

Table 4.12: Test Results of Dependent Variable: Gstructure-Eq (3.23)

Variable	Gstructure		
	Pooled OLS	Random Effect	Fixed Effect
Breusch-Pagan LM test	538.22 (0.0000) ***		—
Robust Hausman test	—	90.284 (0.0000) ***	
Observations	450	450	450
Multicollinearity(vif)	—	—	8.25
Heteroskedasticity (χ^2 -stat)	—	—	552.64 (0.0000) ***
Serial Correlation (F-stat)	—	—	82.481 (0.0000) ***
Durbin-Wu-Hausman Test	22.902 (0.0000) ***		

Note: ①Figures in the parentheses are p-values. ②*** indicates significance at the 1% significance levels; standard errors corresponding to estimated coefficients are in parentheses for each variable.

The results of the multicollinearity test indicate that none of the variables in the three equations (equations (3.21), (3.22), and (3.23)) exhibit multicollinearity. Both the heteroskedasticity test and the serial correlation test reveal the presence of heteroskedasticity and autocorrelation in all three equations, which may render the traditional Hausman test invalid. To maintain robustness in the presence of heteroskedasticity and autocorrelation, the Robust Hausman Test, specifically the Sargan-Hansen test, was applied to adjust the original

model. The adjusted results indicate that fixed effects outperform random effects across all three equations. Additionally, the Breusch-Pagan LM test suggests that random effects are superior to pooled OLS regression for all three equations. As a result, fixed effects were employed for the regression of all three equations in the system of simultaneous equations.

Furthermore, The Durbin-Wu-Hausman test indicates endogeneity in all three equations, and the 3SLS method effectively addresses the endogeneity arising from bidirectional causality. Given the presence of heteroskedasticity and autocorrelation in these equations, clustered robust standard errors were utilized in the subsequent 3SLS regression to mitigate the impact of heteroskedasticity and autocorrelation.

4.4 Discussion on 3SLS Estimation Results

To examine the direct and indirect effects of VFI on Quality, this study conducts benchmark regressions using 3SLS with national and regional samples to determine the direction and magnitude of the variables' impacts. Subsequently, the measure of VFI is altered and the 3SLS regression is re-conducted to discuss the robustness of the benchmark regression results. Finally, the independent variables are standardized to analyze the pathways and transmission mechanisms, testing the existence and magnitude of indirect effects.

4.4.1 Discussion on the National Results

- Descriptive Statistics

All the data used in this study can be obtained from the China Statistical Yearbook, provincial statistical yearbooks, the CEIC statistical database, the EPS database, the China Population and Employment Statistical Yearbook, and the China Foreign Economic Statistical Yearbook, which spans the period of 2008–2022. Descriptive statistics for each variable are shown in Table 4.13.

Table 4.13 presents the means, maximum values, minimum values, and standard deviations of the explanatory and dependent variables for 30 provinces in China from 2008 to 2022. It is clear that the mean value of Quality is 0 due to standardization. The minimum value is -1.75, which is below the national average, while the maximum value is 7.58, significantly higher than the national average. This suggests a noticeable disparity in economic development quality across regions.

The mean value of Teffort is 1.0021, implying that, on average, provinces fully collect their potential tax revenues. The maximum value is 1.3027, and the minimum value is 0.7678, indicating that some regions have relaxed their tax efforts, while others have tightened tax incentives to enhance tax effort.

The average value of VFI is 0.6855, showing that it is common nationwide for local general public budget revenues to be less than expenditures. The maximum value is 0.9383,

and the minimum value is 0.1490, with the maximum value being 6.3 times the minimum value, demonstrating a significant disparity in vertical fiscal imbalance among provinces.

The average value of Gstructure is 0.6015, showing that, on average, 60.15% of provincial expenditures are allocated to livelihood projects. The maximum value is 0.7108, and the minimum value is 0.4274, showing considerable variation in expenditure on livelihood projects among provinces.

In addition, among the control variables, except for local government competition (Compete), most hover around their means without abnormally large or small values. The mean value of local government competition is 3.6960, with a maximum value of 17.1979 and a minimum value of 0.4697, which are 4.65 times and 0.13 times the mean, respectively, indicating significant differences in competition levels among provinces.

Table 4.13: Descriptive Statistics for Variables

Variable	Sample Size	Standard Errors	Minimum	Maximum	Average
Quality	30×15	1.2424	-1.7500	7.5800	0.0000
Teffort	30×15	0.0878	0.7678	1.3027	1.0021
VFI	30×15	0.1909	0.1490	0.9383	0.6855
Gstructure	30×15	0.0471	0.4274	0.7108	0.6015
Open	30×15	0.3263	0.0076	1.6701	0.2929
Ind	30×15	0.0932	0.2979	0.8373	0.4764
Gscale	30×15	0.1093	0.0969	0.7583	0.2472
Compete	30×15	2.8549	0.4697	17.1979	3.6960
Transfer	30×15	0.1691	0.0319	0.7528	0.4810
Urban	30×15	0.1343	0.2824	0.8960	0.5696
Density	30×15	1.2838	2.0337	8.2753	5.4537
Ptax	30×15	0.8144	6.3235	10.4425	8.2508
Pgdp	30×15	0.5761	2.0592	5.2338	3.7117
Fss	30×15	0.3963	-1.9088	-0.0504	-0.7689

Table 4.13 continued

Variable	Sample Size	Standard Errors	Minimum	Maximum	Average
Capital	30×15	1.1977	1.2962	8.9488	4.1312

Sources: Original data from China National Bureau of Statistics (2023), then calculated by the author using Stata 17.0.

● Analysis of Empirical Results

In this study, we employ a fixed-effects model to perform baseline regression estimations of the parameters. The estimation results for the various models are presented in Table 4.14. The regression coefficients obtained from the baseline regressions are generally consistent and align well with the expected outcomes. Specifically, columns 1, 2, and 3 of Table 4.14 show the regressions of the control variables for equations (3.21), (3.22), and (3.23), respectively. Columns 4, 5, and 6 display the regressions after including the core explanatory variables. The adjusted goodness-of-fit in columns 4, 5, and 6 improves compared to columns 1, 2, and 3.

Table 4.14: Baseline of Equation Quality, Teffort, and Gstructure

Dependent Variables	(3.21a)	(3.22a)	(3.23a)	(3.21b)	(3.22b)	(3.23b)
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI				-2.881*** (-5.156)	-0.364** (-2.546)	0.565*** (7.592)
Teffort				-1.341*** (-6.351)		
Gstructure				0.892* (1.231)		
Open	-0.405*** (-3.602)			-1.096*** (-6.974)		
Ind	10.144*** (26.735)			8.439*** (23.663)		
Gscale	0.127 (0.456)			2.007*** (5.803)		

Table 4.14 continued

Dependent Variables	(3.21a)	(3.22a)	(3.23a)	(3.21b)	(3.22b)	(3.23b)
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Compete		0.013*** (4.349)	-0.001 (-1.344)		0.014*** (4.533)	-0.000 (-0.339)
Transfer		0.061 (1.358)	0.071*** (3.622)		0.071 (1.572)	0.096*** (5.080)
Urban		1.790*** (9.741)	-0.310*** (-12.200)		1.765*** (9.582)	0.014 (1.285)
Density		-0.660*** (-7.338)	-0.007*** (-2.646)		-0.644*** (-7.121)	-0.149*** (-4.145)
Ptax		0.590*** (20.290)			0.565*** (17.146)	
Pgdp		-1.015*** (-19.117)	0.016** (1.427)		-0.980*** (-16.998)	0.032*** (2.986)
Fss			0.128*** (5.143)			0.260*** (8.349)
Capital			0.000 (0.234)			0.010** (3.534)
D	0.663*** (9.388)	0.128*** (9.893)	0.031*** (4.997)	0.787*** (12.765)	0.127*** (9.767)	0.016*** (3.236)
Constant	-5.114*** (-34.521)	2.383*** (5.418)	0.640*** (28.376)	-0.399 (-0.772)	2.484*** (5.595)	1.156*** (6.354)
Adjust R ²	0.815	0.678	0.641	0.863	0.822	0.831

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Beijing and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

Two approaches are employed to estimate equations (3.21), (3.22), and (3.23): single-equation estimation and system estimation. The single-equation estimation approach often overlooks the interconnections among the equations as well as the correlations between their error terms. In contrast, the system estimation method addresses these limitations. Generally, estimating all equations simultaneously as a system is more efficient. When the variables in equations (3.21), (3.22), and (3.23) are strictly exogenous, meaning no

endogenous explanatory variables are present, both OLS single-equation estimation and system estimation will yield consistent results. However, if these equations contain endogenous explanatory variables, the use of 2SLS can address endogeneity concerns, although it fails to account for potential correlations between the disturbance terms across equations. By employing the 3SLS estimation method, both endogeneity in the model and correlations between the disturbance terms can be addressed, thereby enhancing the validity.

To maintain consistency, the control variables used in the covariate model were set the same as in the baseline model. Based on the order and rank conditions for the identification of panel covariance models, each equation in the model is over-identified. As a result, this study employs a progression of econometric models, starting from basic regression analysis and advancing to a discussion of endogeneity. The models are estimated using both 2SLS and 3SLS methods. The detailed estimation results are presented in Table 4.15.

Table 4.15: Benchmark Regression Results of the Nation

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-1.957** (-2.537)	-0.299*** (-3.235)	0.454*** (6.635)	-2.525*** (-3.799)	-0.312*** (-3.594)	0.348*** (6.378)
Teffort	-0.472* (-1.451)			-0.870*** (-3.676)		
Gstructure	15.088*** (6.638)			13.070*** (6.438)		
Open	-1.327*** (-5.965)			-1.149*** (-6.781)		
Ind	-4.960*** (-4.377)			-0.244 (-0.276)		

Table 4.15 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Gscale	7.935*** (6.436)			4.711*** (5.304)		
Compete		0.005** (2.262)	-0.003** (-2.311)		0.005** (2.300)	-0.001* (-1.476)
Transfer		-0.101*** (-3.014)	0.103*** (5.622)		-0.103*** (-3.265)	0.132*** (9.641)
Urban		0.857*** (6.501)	0.040 (0.565)		0.862*** (6.945)	-0.092* (-1.862)
Density		-0.730*** (-12.144)	-0.074** (-2.283)		-0.724*** (-12.786)	-0.066*** (-2.884)
Ptax		0.850*** (29.240)			0.841*** (30.830)	
Pgdp		-1.459*** (-32.560)	0.020 (1.035)		-1.453*** (-34.474)	0.051*** (3.783)
Fss			0.181*** (5.740)			0.129*** (5.447)
Capital			-0.004 (-1.182)			-0.002 (-0.790)
D	2.473*** (14.897)	0.478*** (9.985)	-0.075*** (-3.019)	2.130*** (14.712)	0.484*** (10.718)	-0.099*** (-5.332)
Constant	-1.768 (-1.285)	3.833*** (9.032)	0.964*** (4.154)	-3.246*** (-2.837)	3.842*** (9.609)	0.898*** (5.514)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9173	0.8005	0.8078	0.9224	0.8005	0.8015
Adjust R ²	0.9160	0.7969	0.8039	0.9212	0.7969	0.7974
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-3.349*** (-11.621)	0.011 (0.527)	-0.102*** (-7.437)	-2.079*** (-9.474)	0.010 (0.538)	-0.100*** (-8.965)
Hebei	-7.007*** (-11.963)	-0.365*** (-4.399)	-0.136*** (-2.701)	-4.786*** (-10.007)	-0.357*** (-4.577)	-0.141*** (-3.853)
Shanxi	-7.230*** (-12.347)	-1.066*** (-9.599)	-0.188*** (-2.975)	-4.819*** (-10.207)	-1.055*** (-10.078)	-0.181*** (-3.971)
Inner Mongolia	-5.903*** (-11.474)	-2.556*** (-10.317)	-0.432*** (-3.161)	-3.645*** (-9.059)	-2.530*** (-10.844)	-0.415*** (-4.287)
Liaoning	-6.371*** (-11.826)	-0.784*** (-8.527)	-0.151*** (-2.785)	-4.235*** (-9.656)	-0.776*** (-8.959)	-0.138*** (-3.508)

Table 4.15 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Jilin	-6.319*** (-11.088)	-1.260*** (-9.063)	-0.226*** (-2.909)	-4.068*** (-8.758)	-1.245*** (-9.510)	-0.225*** (-4.034)
Heilongjiang	-6.810*** (-10.184)	-1.556*** (-9.000)	-0.277*** (-2.940)	-4.070*** (-7.580)	-1.539*** (-9.456)	-0.261*** (-3.848)
Shanghai	-0.643*** (-3.052)	0.760*** (11.153)	0.000 (0.008)	-0.148 (-0.830)	0.753*** (11.722)	-0.005 (-0.200)
Jiangsu	-4.887*** (-12.219)	0.242*** (6.245)	-0.070*** (-2.940)	-3.323*** (-10.573)	0.241*** (6.621)	-0.078*** (-4.513)
Zhejiang	-5.266*** (-12.607)	-0.169*** (-3.234)	-0.058* (-1.807)	-3.699*** (-10.862)	-0.166*** (-3.380)	-0.058** (-2.517)
Anhui	-6.523*** (-11.475)	-0.283*** (-3.610)	-0.148*** (-3.183)	-4.354*** (-9.436)	-0.276*** (-3.733)	-0.159*** (-4.635)
Fujian	-5.783*** (-11.993)	-0.283*** (-3.298)	-0.182*** (-3.536)	-3.940*** (-10.348)	-0.277*** (-3.430)	-0.179*** (-4.824)
Jiangxi	-7.126*** (-11.371)	-0.705*** (-6.848)	-0.181*** (-3.065)	-4.623*** (-9.149)	-0.694*** (-7.163)	-0.185*** (-4.333)
Shandong	-6.224*** (-12.477)	0.130** (2.366)	-0.098*** (-2.763)	-4.341*** (-10.750)	0.131** (2.542)	-0.102*** (-3.954)
Henan	-7.410*** (-11.125)	0.296*** (4.363)	-0.096** (-2.366)	-4.976*** (-9.076)	0.298*** (4.671)	-0.108*** (-3.523)
Hubei	-6.454*** (-11.149)	-0.290*** (-3.178)	-0.166*** (-3.149)	-4.328*** (-9.114)	-0.283*** (-3.287)	-0.166*** (-4.266)
Hunan	-6.644*** (-11.278)	-0.212** (-2.264)	-0.163*** (-3.018)	-4.491*** (-9.281)	-0.205** (-2.325)	-0.167*** (-4.207)
Guangdong	-4.984*** (-11.504)	-0.287*** (-6.159)	-0.046 (-1.616)	-3.531*** (-9.791)	-0.284*** (-6.483)	-0.036* (-1.712)
Guangxi	-7.421*** (-11.592)	-0.865*** (-7.202)	-0.167** (-2.481)	-5.025*** (-9.527)	-0.853*** (-7.540)	-0.175*** (-3.603)
Hainan	-6.558*** (-12.645)	-1.179*** (-11.380)	-0.197*** (-3.544)	-4.460*** (-10.568)	-1.165*** (-11.943)	-0.194*** (-4.763)
Chongqing	-5.379*** (-11.474)	-0.415*** (-5.175)	-0.195*** (-4.121)	-3.499*** (-9.366)	-0.408*** (-5.407)	-0.190*** (-5.474)
Sichuan	-6.422*** (-11.059)	-0.975*** (-7.622)	-0.229*** (-3.178)	-4.153*** (-8.843)	-0.962*** (-7.985)	-0.229*** (-4.434)
Guizhou	-7.954*** (-12.116)	-1.306*** (-10.508)	-0.152** (-2.274)	-5.343*** (-9.946)	-1.290*** (-11.021)	-0.167*** (-3.478)
Yunnan	-7.151*** (-11.811)	-1.412*** (-9.370)	-0.220*** (-2.658)	-4.786*** (-9.648)	-1.395*** (-9.831)	-0.223*** (-3.781)

Table 4.15 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Shanxi	-7.001*** (-11.361)	-0.934*** (-7.696)	-0.192*** (-2.797)	-4.575*** (-9.123)	-0.921*** (-8.058)	-0.193*** (-3.913)
Gansu	-7.656*** (-11.024)	-1.803*** (-9.448)	-0.231** (-2.256)	-4.884*** (-8.633)	-1.783*** (-9.920)	-0.241*** (-3.340)
Qinghai	-7.663*** (-9.786)	-3.391*** (-10.987)	-0.389** (-2.407)	-4.367*** (-7.096)	-3.357*** (-11.548)	-0.395*** (-3.474)
Ningxia	-6.286*** (-10.710)	-1.641*** (-10.239)	-0.310*** (-3.623)	-3.736*** (-8.045)	-1.621*** (-10.744)	-0.313*** (-5.133)
Xinjiang	-7.302*** (-10.957)	-2.896*** (-10.621)	-0.388*** (-2.640)	-4.572*** (-8.494)	-2.866*** (-11.160)	-0.379*** (-3.646)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.297*** (2.785)	0.010 (0.817)	-0.024*** (-3.605)	0.314*** (3.126)	0.012 (0.973)	-0.027*** (-4.499)
2010.year	0.672*** (4.616)	0.035** (2.357)	-0.052*** (-6.352)	0.689*** (5.065)	0.037*** (2.631)	-0.057*** (-8.334)
2011.year	0.803*** (5.562)	0.015 (0.776)	-0.065*** (-6.578)	0.842*** (6.221)	0.018 (0.992)	-0.071*** (-8.929)
2012.year	0.764*** (5.305)	-0.021 (-0.867)	-0.076*** (-6.382)	0.828*** (6.189)	-0.017 (-0.730)	-0.083*** (-8.947)
2013.year	0.599*** (4.400)	-0.014 (-0.508)	-0.067*** (-5.140)	0.680*** (5.556)	-0.009 (-0.357)	-0.075*** (-7.339)
2014.year	1.034*** (6.470)	0.004 (0.123)	-0.087*** (-6.167)	1.013*** (6.941)	0.009 (0.314)	-0.097*** (-8.816)
2015.year	1.281*** (7.267)	0.027 (0.863)	-0.092*** (-6.174)	1.192*** (7.428)	0.032 (1.093)	-0.104*** (-8.970)
2016.year	1.540*** (7.786)	0.088*** (2.659)	-0.098*** (-6.037)	1.412*** (7.878)	0.093*** (2.988)	-0.111*** (-8.949)
2017.year	1.629*** (8.576)	0.180*** (5.167)	-0.082*** (-4.639)	1.447*** (8.569)	0.184*** (5.631)	-0.097*** (-7.267)
2018.year	1.828*** (9.884)	0.241*** (6.277)	-0.078*** (-4.032)	1.588*** (9.670)	0.246*** (6.805)	-0.094*** (-6.441)
2019.year	2.267*** (11.635)	0.260*** (6.245)	-0.082*** (-3.894)	1.958*** (11.333)	0.265*** (6.774)	-0.099*** (-6.330)
2020.year	0.281** (2.387)	-0.113*** (-9.622)	-0.026*** (-4.266)	0.282** (2.536)	-0.113*** (-10.186)	-0.025*** (-4.464)
2021.year	-0.099 (-0.954)	-0.024** (-2.142)	-0.006 (-1.019)	-0.054 (-0.558)	-0.025** (-2.290)	-0.008 (-1.439)

Table 4.15 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Beijing and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

◆ Discussion on the Results of the Quality Equation

First, the results in the second and fifth columns of the model reveal a negative estimated coefficient for VFI, supporting research hypothesis 1 and indicating that the inhibitory effect of VFI outweighs its promotional effect. Specifically, for every unit increase in VFI, Quality decreases by 2.525 units, suggesting that VFI suppresses Quality (Bao et al., 2017; Sun et al., 2019; Wang et al., 2020; Song et al., 2021; Wei et al., 2021). In the current context of China, VFI tends to hinder rather than enhance Quality. Several factors might explain this: an increase in VFI indicates a growing disparity between local revenue and expenditure decentralization, which in turn exacerbates financial pressures on local governments.

The positive impact of VFI on Quality is primarily associated with creating a stable institutional environment, the role of transfer payments in resource allocation, and interregional learning and competition at the macro level effects that are typically long-term and gradual. Conversely, the negative impacts are more immediate and short-term, manifesting in three key ways. First, local governments' overreliance on transfer payments

and central financial support has resulted in problems such as relaxed budgetary constraints and diminished tax collection efforts. Second, in the scramble for limited resources, local governments have engaged in intergovernmental competition, leading to negative outcomes like local protectionism, duplicated infrastructure projects, and market segmentation, which hinder market-based division of labour and resource allocation. Third, within the framework of political centralization and performance-based evaluations, a growth competition has emerged in China, causing local officials to engage in short-sighted behaviours, such as weakening oversight of businesses or compromising the environment for short-term economic gains, ultimately undermining the sustainability of economic development (Chu et al., 2019).

Second, the negative estimated coefficient of Teffort supports Hypothesis 3, indicating that each unit increase in Teffort leads to a 0.870 unit decrease in Quality. This suggests that Teffort inhibits Quality. The study attributes this effect primarily to the adverse impact of higher Teffort by local governments, which significantly reduces market participants' enthusiasm. This reduction leads to a shrinking tax base, loss of tax sources, and a decline in tax revenues. The detrimental effects of this disincentive far outweigh the benefits of improved tax collection efficiency. Additionally, the inhibitory effect reflects the counterproductive impact of local governments' gradual tax increases, which undermine the positive outcomes of tax reforms intended to reduce the burden on market participants. Consequently, despite the introduction of various tax and fee reduction policies, there has

been no significant improvement in business development or consumer spending (Chu & Fei, 2021).

Third, the positive estimated coefficient of Gstructure on Quality supports Hypothesis 6, showing that public expenditure focused on livelihood expenditures promotes Quality (Tulsidharan, 2006; Gong & Lu, 2009; Meričková et al., 2017; Amusa & Oyinlola, 2019; Liu et al., 2023). Specifically, for each unit increase in Gstructure, Quality improves by 4.711 units. This study believes that the possible three reasons are as follows. First, livelihood expenditures include general government service spendings, public security spendings, social security and employment spendings, medical security spendings, science and technology spendings, education spendings, cultural, sports and media spendings, medical and health spendings, and environmental protection spendings, which comprise a total of nine categories of spendings. These are positive indicators that play a direct or indirect role in the system of indicators of Quality, and thus public expenditure in favour of livelihood expenditure will inevitably lead to an improvement in the indicators of Quality. Second, a moderate gap between local governments' revenues and expenditures is theoretically conducive to the central government's performance of its macro-control function by means of transfer payments, and the central government guides regional governments to increase inputs for livelihood projects by optimizing the structure of transfer payments. The third is that the increase in livelihood expenditures can affect residents' disposable income and the consumption environment, thus generating both the crowding-out effect and the multiplier effect on residents' consumption. The empirical results show

that the increase in expenditure on people's livelihood in China is greater than the value added of the tax revenue increased by the government in order to raise expenditure on people's livelihood, i.e. the multiplier effect is even greater. The increase in livelihood expenditure brings about an increase in residents' disposable income and an improvement in the consumption environment, thus promoting Quality.

Fourth, regarding the control variables, there is a significant negative correlation between Open and Quality. This result is also reflected in some studies. For example, Chu and Shao (2018) point out that at certain stages of development, excessive reliance on openness may lead to industrial hollowing-out and environmental degradation, thereby negatively impacting Quality. This study suggests that while China's past export-driven growth has fuelled rapid economic expansion, the increasing economic output and growing demands for a better life require a shift in the opening-up strategy. Future strategies should focus on local governments absorbing advanced practices from developed countries and emphasizing the quality of foreign capital to better meet the evolving needs of the population (Ren, 2018).

Ind exhibits a negative inhibitory effect on Quality, meaning that the optimization and upgrading of the industrial structure impede the advancement of Quality, although this effect is not significant. Similarly, studies such as Wei et al. (2021) have found that slow industrial upgrading may reduce the sustainability of economic growth, thereby affecting Quality. The tertiary sector, which primarily includes services, often shows slower rates of innovation and technological progress compared to the secondary sector (manufacturing and

industry). Economic development quality relies on continuous innovation and technological advancement to drive productivity gains and long-term growth. Additionally, the tertiary sector is often concentrated in urban and more developed areas, potentially exacerbating income inequality and regional disparities. Economic development quality aims to achieve more inclusive growth, ensuring that the benefits of development are widely shared across different regions and social groups (Shi & Ren, 2018).

Gscale significantly promotes Quality. This study identifies the following five potential reasons. This result is consistent with the findings of Chu et al. (2020), which indicate that fiscal expenditure can enhance Quality within a certain range, but its marginal effect may diminish as the scale of expenditure increases. First, local government spending on infrastructure such as transportation, utilities, and public facilities can enhance productivity by reducing costs and improving efficiency. High-quality infrastructure supports economic activities, attracts investment, and promotes regional integration, all of which are crucial for sustainable economic growth. Second, local governments typically allocate a significant portion of their budgets to education, healthcare, and social services. These investments in human capital improve the quality of the workforce, increase productivity, and foster innovation. Enhanced human capital is the cornerstone of economic development quality, as it underpins long-term growth and competitiveness. Third, local government expenditures can address regional disparities by directing funds to less developed areas, promoting balanced regional development. This approach helps mitigate income inequality and ensures that the benefits of economic development are more evenly

distributed across different regions and social groups, contributing to more inclusive growth. Fourth, regional authorities play a critical role in implementing environmental policies and sustainable development initiatives. Budget expenditures directed towards environmental protection, green infrastructure, and clean energy projects contribute to sustainable development goals, aligning economic growth with ecological sustainability. At last, by providing adequate public services such as public safety, sanitation, and welfare programs, local government spending enhances social stability and public well-being. A stable social environment is essential for attracting investment, fostering entrepreneurship, and ensuring steady economic development (Chu & Fei, 2021).

The decrease in Quality for 2021 compared to 2020 is due to the short time frame and the impact of COVID-19 on Quality is not truly reflected. Then, dummy variable Covid-19 significantly improves Quality. The study attributes this to the Chinese government's proactive response.

First, during the pandemic, the rapid adoption of remote work, online education, and e-commerce accelerated the development of the digital economy. The government heavily invested in new infrastructure (such as 5G, artificial intelligence, and big data) to support the digital economy. Additionally, the government introduced a series of policies to support technological innovation, such as the New Infrastructure Development Plan and tax incentives, encouraging enterprises to increase R&D investment and enhance technological innovation capabilities.

Second, the reverse urbanization phenomenon highlighted the importance of rural areas. The government increased support for rural revitalization and introduced the Rural Revitalization Strategic Plan to promote rural economic development, increase rural incomes, and narrow the urban-rural gap. Efforts to promote new urbanization, enhance the capacity of small and medium-sized cities and counties, optimize urban functional layouts, and promote coordinated urban-rural development were also significant.

Third, improved air quality during the pandemic raised public environmental awareness, leading the government to prioritize green development. The government issued the 14th Five-Year Plan for Ecological Environmental Protection to promote green economic transformation. Increased support for the new energy industry, promotion of renewable energy development, reduction of dependence on traditional fossil fuels, and advancement of sustainable economic development were key measures.

Fourth, as the global supply chain was disrupted by the pandemic, China bolstered international market confidence through policies to stabilize foreign trade and investment. This facilitated the formation of a new development pattern, where domestic circulation is the primary focus, with domestic and international circulation reinforcing each other. The Chinese government introduced a series of open policies, such as the expansion of free trade zones and the implementation of the Foreign Investment Law, to further open up and attract more international investment.

Fifth, the pandemic exposed deficiencies in the public health system, prompting the government to increase investment in public health, education, medical services, and other public services, thereby improving their quality and enhancing social welfare. The government also implemented a series of social security measures, such as unemployment insurance and housing guarantees, to raise social security levels and ensure that the benefits of economic development are more broadly shared.

In terms of individual effects, when all independent variables are zero, Quality in Beijing is -3.246. Tianjin is 2.079 lower than Beijing, i.e., -5.325. Hebei is 4.786 lower than Beijing, i.e., -8.032. Other provinces follow this pattern, with Guizhou ranking the lowest, 5.343 lower than Beijing, consistent with the description in section 4.2.2.

In terms of time effects, using 2008 as the baseline for economic development quality, 2009 saw an increase of 0.314 units compared to 2008, and 2010 saw an increase of 0.689 units compared to 2008, with successive annual increases. However, due to the impact of the Covid-19 pandemic, 2020 saw only a 0.282-unit increase. In 2021, there was a decrease of 0.054 units compared to 2008, and 2022.year is omitted due to collinearity.

◆ Discussion on the Results of the Teffort Equation

First, there is a significant negative correlation between VFI and Teffort, indicating that an increase in the degree of VFI significantly reduces the level of Teffort (Baretti, et al., 2002; Jia & Ying, 2016; Chu et al., 2019; Zhao et al., 2021), which empirically supports Hypothesis 2. This study argues that the main reason is that, on the one hand, although a

moderate VFI can be designed to incentivize local governments to raise tax revenues in order to perform their duties, the relatively high level of vertical fiscal imbalance in China has weakened this positive incentive. On the other hand, the elevated level of VFI amplifies its negative impact on Teffort, further exacerbated by local governments' over-reliance on central government transfers. Unlike in Western fiscal federalist countries, China's decentralization reform, rooted in a unitary political system, not only leads to a higher degree of VFI due to the asymmetry between revenue and expenditure decentralization but also intensifies the negative inhibitory effect of VFI on Teffort, while weakening the positive incentives of VFI. This explains why VFI in China has a significant negative effect on local governments' Teffort.

Second, the regression coefficient of Compete on Teffort is 0.005, significant at the 5% level, indicating that increased competition significantly enhances Teffort (Xie & Fan, 2015; Chu & Fei, 2021; Brülhart & Jametti, 2019). Specifically, for every one-unit increase in Compete, Teffort rises by an average of 0.005 units. This effect can be attributed to the shift in economic development goals, which has led to changes in regional authority policy implementation. As China's budget management system continues to improve, local governments are increasingly focused on enhancing basic public services for residents, which drives them to intensify their Tefforts to secure sufficient fiscal revenue. Consequently, local governments' Tefforts have been notably strengthened.

There is a significant negative correlation between Transfer and Teffort, meaning that an increase in Transfer reduces Teffort (Liu & Liu, 2015; Zhou et al., 2022). Specifically,

the regression coefficient of Transfer on Teffort is -0.103, significant at the 1% level, indicating that a one-unit increase in Transfer results in a 0.103 unit decrease in Teffort. On one hand, increased Transfer can substantially relieve the financial pressures on local governments, leading them to rely on transfer funds instead of their own tax revenues, which reduces Teffort. On the other hand, motivated by the public pool effect, local governments may exploit the redistributive aspect of transfer funds to benefit from economic developments in other regions, diminishing their own incentives for development. This finding suggests that China's current transfer payment system not only fails to positively influence local governments' tax behaviours but also exacerbates local tax competition and weakens Teffort (Tang and Ye, 2020).

The regression coefficient for Density is -0.724, significant at the 1% level, indicating that higher Density significantly inhibits local governments' Teffort (Liu & Zhang, 2022). This study posits that increased Density complicates tax collection and enforcement, thereby reducing Teffort.

There is a significant positive correlation between Ptax and Teffort, meaning that an increase in Ptax enhances Teffort (Song et al., 2021). Specifically, the regression coefficient of Ptax on Teffort is 0.841, significant at the 1% level, indicating that a one-unit increase in Ptax results in a 0.841 unit increase in Teffort. On one hand, higher Ptax implies that local governments have greater financial resources, enabling them to provide more public services, infrastructure, and social welfare, due to the increased availability of funds. On the other hand, a thriving local economy with more profitable businesses leads to higher tax revenues,

making it easier for local governments to implement tax policies, as businesses and individuals have a greater capacity to pay.

Pgdp shows a significant negative correlation with Teffort, indicating that an increase in Pgdp reduces Teffort (Cai & Chen, 2023). Specifically, the regression coefficient of Pgdp on Teffort is -1.453, significant at the 1% level. This means that for every one-unit increase in Pgdp, Teffort decreases by 1.453 units. On one hand, higher Pgdp may attract more affluent individuals to the area. As Pgdp increases, the proportion of wealthy residents rises, who generally have a lower tolerance for higher taxes and may seek to avoid them through various means, which pressures local governments to reduce tax collection and lessens their willingness to implement higher tax policies. On the other hand, some local governments might adopt more conservative tax policies, maintaining relatively low tax levels to attract investment and promote economic growth, even as Pgdp rises.

The urbanization rate significantly promotes the quality of economic development in China (Zhang et al., 2023). The possible reasons for this are as follows. First, urbanization brings the agglomeration of population and enterprises, generating economies of scale, improving production efficiency, and reducing production costs. High-density urban environments facilitate the exchange and dissemination of knowledge and technology, spurring innovation and enhancing overall innovation capacity. Second, urbanization necessitates substantial infrastructure investment in transportation, housing, public facilities, etc. These investments not only directly drive economic growth but also lay the foundation for long-term development. In the process of urbanization, the service sector, particularly

high-end services like finance, information technology, and cultural creativity, develops rapidly. These industries cluster in cities, enhancing economic value-added. Third, urbanization absorbs a large rural labour force, increases rural residents' incomes, promotes urban-rural integration, and narrows the urban-rural gap. The construction of urban agglomerations and metropolitan areas stimulates the development of surrounding regions, forming a new pattern of coordinated regional development.

Under the proactive response and policy support of the Chinese government, Covid-19 significantly improved local government tax effort. The possible reasons are as follows. First, the pandemic accelerated the development of the digital economy, with emerging industries such as e-commerce, online education, and remote work rapidly rising, becoming new sources of tax revenue for local governments. The development of the digital economy expanded the tax base, increasing actual tax revenue. Second, the government issued the 14th Five-Year Plan for Ecological Environmental Protection, promoting green economic development. Measures such as environmental protection taxes and carbon emission taxes increased local governments' tax effort. The development of green industries and the implementation of environmental taxes increased actual tax revenues. Third, the government increased investment in public health, education, medical services, and other public services, improving residents' quality of life and promoting consumption growth, indirectly increasing local tax revenues. The enhancement of public services stimulated economic development, increasing actual tax revenues.

In terms of individual effect, when all independent variables are zero, the tax effort in Beijing is 3.842. Tianjin is 0.010 lower than Beijing, at 3.852, but this is not significant. Provinces with higher tax effort than Beijing include Shanghai (4.595), Jiangsu (4.083), Shandong (3.973), and Henan (4.140), with Shanghai having the highest tax effort at 4.595. The tax effort of the remaining 25 provinces is lower than that of Beijing, with Qinghai having the lowest at 0.485, 3.357 lower than Beijing, consistent with the description in section 4.2.3.

In terms of time effect, using 2008 as the baseline for tax effort, 2009 saw an increase of 0.012 units compared to 2008, but this was not significant. Similar non-significant changes are observed for 2011 to 2015, likely due to a stable economic environment with no major policy changes or economic shocks. From 2016 to 2019, tax effort significantly increased compared to 2008, due to the implementation of value added tax (VAT) reform in 2016, which expanded VAT to include services previously taxed under business tax. Due to the impact of the Covid-19 pandemic, tax effort declined in 2020 and 2021, with actual tax revenues decreasing. Due to collinearity, 2022.year is omitted.

◆ Discussion on the Results of the Gstructure Equation

The fourth and seventh columns of the model show that there is a significant positive correlation between VFI and Gstructure, i.e., along with an increase in VFI, the proportion of livelihood-based expenditure in Gstructure rises. This is demonstrated by the fact that for every one unit increase in VFI, the livelihood expenditure share increases by an average of

0.348 units, failing to test the research hypothesis 5 This is inconsistent with previous studies (Fu & Zhang, 2007; Gong & Lu, 2009; Amusa & Oyinlola, 2019; Liu et al., 2023).

Although the theoretical analysis in this study suggests that local governments under the background of VFI, faced with the dual incentives of bridging the gap between revenues and expenditures and the urgent need for capital promotion, will inevitably engage in economic tournaments or growth competitions. This in turn leads to a public expenditure structure that is biased towards constructive economic expenditures because of the emphasis on the economy, not on people's livelihoods. However, the above empirical results show that there is a deviation between the theoretical analysis and the real situation, i.e. the current higher VFI in China has not only not exacerbated the bias of Gstructure towards economically constructive expenditures, but also increased the proportion of livelihood expenditures, which in turn has had a corrective effect on the structural heterogeneity of public expenditures.

The causes of this phenomenon, according to this study, can be interpreted from the following three aspects. First, the adjustment and optimization effect of the central transfer payment system. Transfer payments can not only provide financial resources for local governments to make up for public expenditure funding gaps, but also serve as an efficient tool for the central authority to regulate financial resources on a national scale. At this point, the central government can use the system design of transfer payments to provide cost compensation for public goods with spillover characteristics or public services with regional externalities, thereby reducing the spillover of local government public expenditure and

incentivizing them to take the initiative to improve the level of public goods supply for people's livelihood in their jurisdictions.

Second, the higher VFI in China has exacerbated the high dependence of local governments on central transfer funds, further reinforcing the adjustment and optimization effects of the transfer system on local public expenditure behaviour.

Third, the gradually deepening concept of people's livelihood requires local governments to place the comprehensive improvement of people's livelihoods at the forefront of government work, to make the promotion of people's well-being the fundamental goal of development, and to further standardize and optimize local governments' public expenditure through the scientific design and qualitative quantification of performance assessment indicators for people's livelihoods work.

Therefore, China's high VFI, due to the large degree of local fiscal revenue and expenditure gaps, has led to a significant positive adjustment effect of transfer payments on the structure of public expenditure. Along with the continuous strengthening of the government's concept of people's livelihood, the two effects eventually led to an increase in the share of livelihood expenditures in the public expenditure structure, which fundamentally explains why China's higher VFI did not lead to a bias towards economically constructive expenditures in the structure of public expenditures, but instead helped to push it to tilt towards livelihood expenditures.

Besides, the regression coefficient for Compete on Gstructure is -0.001, and it is significant at the 10% level, indicating that horizontal competition among local governments significantly inhibits the optimization of Gstructure (Zhu & Liu, 2020). The reasons analysed in this study are as follows. Facing horizontal competitive pressure, local governments can proactively alter the expenditure structure to leverage the differential impacts of various expenditures on economic growth, thereby improving their ranking in the economic tournament to gain greater promotion benefits. As part of the national administrative system, local governments have the basic responsibilities of accountability to higher authorities and duty to lower levels.

However, as rational actors, local officials also consider their own economic or promotional interests when implementing or formulating policies. This dual identity of regional authorities necessitates a balance between the economic and social performance of different expenditure items in their decision-making. On one hand, due to information asymmetry, the central government focuses on more visible economic performance, leading local governments to overly favour productive expenditures. On the other hand, the positive effects of livelihood expenditures have a longer time lag, and given the typical five-year term of Chinese officials, these positive effects are unlikely to benefit the incumbent officials. Therefore, local governments, when facing intense competition, tend to prefer productive construction expenditures at the expense of livelihood expenditures. In other words, regional authority competition is detrimental to the optimization of local expenditure structures.

There is a significant positive correlation between Transfer and Gstructure, i.e., the increase in Transfer significantly improves the proportion of local livelihood expenditures (Wei et al., 2021). First, equalization transfers can effectively alleviate the pressure of income and expenditure gaps faced by local governments by increasing their disposable incomes, thus contributing to a significant increase in local governments' livelihood expenditures, which were originally limited by limited incomes and could not be adequately safeguarded. Second, in the traditional development mode of pursuing economic growth rate, local governments scramble to expand the proportion of productive expenditures to rapidly boost the local economic level, and this development mode brings negative problems such as repetitive construction, overcapacity and imbalance of industrial structure, etc., which are becoming more and more significant impediments to the current economic development. Therefore, the revenue increase brought by Transfer is significantly higher than that invested in productive areas. Finally, the shift of the government's macroeconomic goals to high-quality development and the change of local officials' assessment orientation have also become important external conditions to motivate local governments to improve livelihood expenditures.

Density is significantly negatively correlated with Gstructure (Chu & Shao, 2018). The possible reasons for this are as follows. Firstly, the increased fiscal pressure brought by high population density may lead local governments to prioritize projects that directly impact economic development over those related to social welfare. Additionally, high population density areas have a higher demand for basic public services. Local governments may

prioritize these essential services, such as public safety, environmental sanitation, and basic education, potentially limiting expenditures in other social welfare areas. Finally, in high population density areas, local governments may focus on improving the business environment to attract investments and enterprises, thereby reducing financial allocations to social welfare sectors.

Urban has a positive but not significant effect on the local government expenditure structure towards social welfare in the 2SLS regression, while it significantly inhibits this structure in the 3SLS regression. The main reasons lie in the model differences and the multifaceted effects of urbanization. The 2SLS model, due to the choice of instrumental variables and the limitations of a single equation, may not fully capture the complex impacts of urbanization. In contrast, the 3SLS model, through the synergistic effects of multiple equations and the consideration of error term correlations, more accurately estimates the significant negative impact of urbanization on the local government expenditure structure. Moreover, urbanization requires substantial funds for infrastructure construction, such as transportation, housing, and utilities. These investments might occupy the local government's budget, reducing the inclination towards social welfare spending. In promoting urbanization, local governments may prioritize infrastructure and economic development investments to foster economic growth and the urbanization process, potentially affecting the priority of social welfare expenditures.

The impact of material capital (Capital) on the local government expenditure structure is negative but not significant. The influence of physical capital on the expenditure

structure may involve both direct and indirect effects. For example, the increase in physical capital might directly improve infrastructure, but its impact on other expenditure areas might be exhibited through indirect channels. This complexity could lead to the insignificance of the regression results.

There is a significant positive relationship between Fss and $Gstructure$, i.e., along with the increase in Fss , $Gstructure$ increases in the degree of bias in favour of livelihood-related expenditures (Zhang & Ma, 2022). Specifically, for every 1 unit increase in Fss , the percentage of livelihood expenditure in the public expenditure structure increases by 0.129 units on average.

The above empirical results are consistent with the previous theoretical analysis, that is, when Fss is low, the local government needs to seek tax sources and fund revenues to alleviate the fiscal pressure, and then it is bound to prefer to invest the financial funds in the field of constructive expenditures that can bring about direct economic benefits, while relatively neglecting the livelihood expenditures. When Fss is high, the local government does not have to bear too much economic growth pressure. Along with the rise in the level of demand for government goods and services of the residents in the jurisdiction, to achieve a higher level of supply of government goods and services, the local authority will inevitably increase the share of livelihood expenditures in the public spendings, which will lead to the tilting of the structure of public expenditures towards livelihood expenditures.

The influence of the Covid-19 dummy variable on the expenditure structure is significantly negative. This study suggests the following possible reasons. The Covid-19 pandemic required local governments to allocate substantial funds for control measures, including testing, quarantine facility construction, vaccine procurement, and distribution. Local governments needed to prioritize public health and safety during the pandemic, concentrating funds on control and emergency management. In contrast, the priority of social expenditures such as education and healthcare may have been lowered. Besides, the pandemic caused a slow economic recovery, leading to significant fiscal pressure on local governments. In times of economic uncertainty, local governments may prioritize spending projects that can directly stabilize and revive the economy in the short term, rather than long-term social expenditures.

In terms of individual effects, when all independent variables are zero, the expenditure structure for Beijing is 0.898. The other 29 provinces are lower than Beijing, with Inner Mongolia being the lowest at 0.483, which is 0.415 lower than Beijing. In terms of time effects, using the expenditure structure in 2008 as the baseline, the expenditure structures in the following years show varying degrees of decline. The year 2022 is omitted due to collinearity.

● Robustness Test

To test the robustness of the previous regression results and mechanism analysis, this study employs an alternative measure of VFI for regression analysis. First, VFI is redefined

and measured from the perspective of the traditional fiscal revenue and expenditure gap. Specifically defined as: $VFI II = 1 - \frac{LP_R}{LP_S}$. Substituting the VFI II into the panel joint equation, the 2SLS and 3SLS methods are used for estimation. The results of the robustness analysis, as shown in Table 4.16, indicate that the sign of the coefficients of VFI, Teffort, Quality, and the other key variables are basically the same, and only the coefficients of the individual control variables are slightly changed, which suggests that the regression results have good robustness.

Table 4.16: Robustness Test Regression Results

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-3.467*** (-4.679)	-0.299*** (-3.235)	0.382*** (6.599)	-4.021*** (-6.134)	-0.309*** (-3.549)	0.346*** (7.075)
Teffort	-0.634** (-2.308)			-0.886*** (-4.008)		
Gstructure	11.025*** (5.488)			12.612*** (6.887)		
Open	-1.348*** (-6.991)			-1.115*** (-6.983)		
Ind	-2.799*** (-3.171)			-0.760 (-1.061)		
Gscale	2.976*** (3.931)			3.334*** (5.611)		
Compete		0.005** (2.262)	-0.002* (-1.668)		0.005** (2.349)	-0.001 (-1.355)
Transfer		-0.101*** (-3.014)	0.025 (1.640)		-0.112*** (-3.545)	0.086*** (7.471)
Urban		0.857*** (6.501)	-0.155** (-2.554)		0.854*** (6.883)	-0.184*** (-3.904)
Density		-0.730*** (-12.144)	-0.112*** (-4.065)		-0.730*** (-12.894)	-0.088*** (-3.879)
Ptax		0.850*** (29.240)			0.845*** (30.853)	
Pgdp		-1.459*** (-32.560)	-0.023 (-1.403)		-1.459*** (-34.555)	0.012 (0.960)

Table 4.16 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Fss			0.115*** (4.296)			0.088*** (3.963)
Capital			-0.007** (-2.570)			-0.004* (-1.947)
D	2.756*** (14.114)	0.478*** (9.985)	0.004 (0.206)	2.636*** (14.829)	0.490*** (10.878)	-0.052*** (-3.060)
Constant	3.783*** (4.990)	3.833*** (9.032)	1.272*** (6.470)	1.813*** (2.874)	3.885*** (9.719)	0.977*** (5.921)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9403	0.8005	0.8290	0.9308	0.8004	0.8190
Adjust R ²	0.9394	0.7969	0.8255	0.9297	0.7968	0.8153
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-3.325*** (-13.514)	0.011 (0.527)	-0.057*** (-4.926)	-2.681*** (-13.324)	0.010 (0.530)	-0.058*** (-5.905)
Hebei	-5.580*** (-12.437)	-0.365*** (-4.399)	-0.259*** (-6.087)	-4.430*** (-11.863)	-0.367*** (-4.703)	-0.229*** (-6.461)
Shanxi	-5.886*** (-13.262)	-1.066*** (-9.599)	-0.301*** (-5.635)	-4.766*** (-12.972)	-1.068*** (-10.205)	-0.253*** (-5.663)
Inner Mongolia	-5.333*** (-12.519)	-2.556*** (-10.317)	-0.549*** (-4.748)	-4.256*** (-12.092)	-2.557*** (-10.955)	-0.462*** (-4.864)
Liaoning	-5.816*** (-12.655)	-0.784*** (-8.527)	-0.162*** (-3.525)	-4.947*** (-12.554)	-0.786*** (-9.071)	-0.126*** (-3.319)
Jilin	-5.134*** (-11.448)	-1.260*** (-9.063)	-0.328*** (-4.980)	-4.133*** (-10.919)	-1.261*** (-9.630)	-0.282*** (-5.221)
Heilongjiang	-5.551*** (-10.564)	-1.556*** (-9.000)	-0.394*** (-4.933)	-4.376*** (-9.969)	-1.559*** (-9.572)	-0.323*** (-4.883)
Shanghai	-1.424*** (-8.608)	0.760*** (11.153)	0.107*** (3.423)	-1.121*** (-7.795)	0.760*** (11.830)	0.083*** (3.230)
Jiangsu	-4.451*** (-13.438)	0.242*** (6.245)	-0.115*** (-5.712)	-3.558*** (-13.001)	0.238*** (6.537)	-0.103*** (-6.110)
Zhejiang	-4.334*** (-13.694)	-0.169*** (-3.234)	-0.155*** (-5.708)	-3.477*** (-13.282)	-0.172*** (-3.509)	-0.128*** (-5.630)
Anhui	-5.120*** (-11.473)	-0.283*** (-3.610)	-0.271*** (-6.858)	-3.952*** (-10.665)	-0.284*** (-3.854)	-0.247*** (-7.485)
Fujian	-4.849*** (-12.607)	-0.283*** (-3.298)	-0.284*** (-6.505)	-3.746*** (-11.971)	-0.285*** (-3.533)	-0.252*** (-6.890)

Table 4.16 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Jiangxi	-5.448*** (-11.409)	-0.705*** (-6.848)	-0.322*** (-6.453)	-4.192*** (-10.654)	-0.706*** (-7.286)	-0.286*** (-6.872)
Shandong	-5.108*** (-13.317)	0.130** (2.366)	-0.193*** (-6.460)	-4.056*** (-12.833)	0.126** (2.443)	-0.173*** (-6.945)
Henan	-5.675*** (-11.362)	0.296*** (4.363)	-0.225*** (-6.563)	-4.415*** (-10.603)	0.292*** (4.579)	-0.208*** (-7.150)
Hubei	-5.356*** (-11.756)	-0.290*** (-3.178)	-0.257*** (-5.754)	-4.249*** (-11.071)	-0.291*** (-3.391)	-0.226*** (-6.011)
Hunan	-5.488*** (-11.828)	-0.212** (-2.264)	-0.273*** (-5.965)	-4.380*** (-11.192)	-0.215** (-2.435)	-0.239*** (-6.199)
Guangdong	-4.060*** (-12.365)	-0.287*** (-6.159)	-0.131*** (-5.492)	-3.373*** (-12.115)	-0.290*** (-6.616)	-0.100*** (-4.842)
Guangxi	-5.499*** (-11.542)	-0.865*** (-7.202)	-0.350*** (-6.113)	-4.357*** (-10.917)	-0.867*** (-7.666)	-0.306*** (-6.441)
Hainan	-5.199*** (-13.212)	-1.179*** (-11.380)	-0.298*** (-6.336)	-4.303*** (-13.021)	-1.178*** (-12.069)	-0.259*** (-6.531)
Chongqing	-4.903*** (-12.609)	-0.415*** (-5.175)	-0.233*** (-5.810)	-3.937*** (-12.104)	-0.417*** (-5.517)	-0.203*** (-6.022)
Sichuan	-5.274*** (-11.452)	-0.975*** (-7.622)	-0.364*** (-5.972)	-4.137*** (-10.755)	-0.977*** (-8.111)	-0.312*** (-6.138)
Guizhou	-5.648*** (-12.043)	-1.306*** (-10.508)	-0.358*** (-6.299)	-4.552*** (-11.601)	-1.307*** (-11.164)	-0.310*** (-6.586)
Yunnan	-5.499*** (-12.025)	-1.412*** (-9.370)	-0.409*** (-5.824)	-4.435*** (-11.540)	-1.414*** (-9.966)	-0.345*** (-5.917)
Shanxi	-5.478*** (-11.793)	-0.934*** (-7.696)	-0.324*** (-5.578)	-4.307*** (-11.159)	-0.935*** (-8.178)	-0.281*** (-5.833)
Gansu	-5.391*** (-10.670)	-1.803*** (-9.448)	-0.469*** (-5.395)	-4.302*** (-10.131)	-1.807*** (-10.049)	-0.396*** (-5.544)
Qinghai	-5.120*** (-9.115)	-3.391*** (-10.987)	-0.632*** (-4.612)	-4.156*** (-8.892)	-3.392*** (-11.666)	-0.529*** (-4.730)
Ningxia	-4.968*** (-10.320)	-1.641*** (-10.239)	-0.429*** (-5.921)	-3.808*** (-9.490)	-1.640*** (-10.864)	-0.378*** (-6.345)
Xinjiang	-5.412*** (-11.065)	-2.896*** (-10.621)	-0.621*** (-4.986)	-4.309*** (-10.592)	-2.897*** (-11.277)	-0.520*** (-5.067)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.308*** (3.150)	0.010 (0.817)	-0.021*** (-3.729)	0.350*** (3.807)	0.012 (0.977)	-0.024*** (-4.726)

Table 4.16 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2010.year	0.693*** (4.571)	0.035** (2.357)	-0.045*** (-6.402)	0.767*** (5.419)	0.037*** (2.655)	-0.052*** (-8.477)
2011.year	0.794*** (5.468)	0.015 (0.776)	-0.041*** (-4.866)	0.858*** (6.313)	0.019 (1.028)	-0.052*** (-7.291)
2012.year	0.884*** (5.629)	-0.021 (-0.867)	-0.046*** (-4.560)	0.941*** (6.397)	-0.016 (-0.684)	-0.062*** (-7.400)
2013.year	1.007*** (5.972)	-0.014 (-0.508)	-0.046*** (-4.147)	1.043*** (6.621)	-0.007 (-0.290)	-0.066*** (-7.167)
2014.year	1.214*** (6.739)	0.004 (0.123)	-0.045*** (-3.730)	1.226*** (7.300)	0.011 (0.396)	-0.069*** (-7.023)
2015.year	1.434*** (7.251)	0.027 (0.863)	-0.045*** (-3.578)	1.432*** (7.786)	0.034 (1.186)	-0.074*** (-7.056)
2016.year	1.746*** (7.617)	0.088*** (2.659)	-0.046*** (-3.391)	1.719*** (8.078)	0.096*** (3.088)	-0.078*** (-6.935)
2017.year	1.880*** (8.596)	0.180*** (5.167)	-0.026* (-1.727)	1.802*** (8.933)	0.188*** (5.750)	-0.062*** (-5.057)
2018.year	2.079*** (9.742)	0.241*** (6.277)	-0.017 (-1.006)	1.976*** (10.058)	0.250*** (6.924)	-0.056*** (-4.156)
2019.year	2.437*** (11.297)	0.260*** (6.245)	-0.010 (-0.565)	2.308*** (11.664)	0.270*** (6.895)	-0.053*** (-3.678)
2020.year	0.134 (1.377)	-0.113*** (-9.622)	-0.022*** (-4.232)	0.135 (1.475)	-0.114*** (-10.264)	-0.018*** (-3.756)
2021.year	-0.034 (-0.371)	-0.024** (-2.142)	-0.009* (-1.669)	-0.041 (-0.468)	-0.025** (-2.294)	-0.010** (-1.984)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Beijing and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

● Analysis of Path of Action Tests and Transmission Effects

Theoretical mechanism analysis and the benchmark regression results clearly indicate that VFI exerts a dual-path effect on Teffort. To distinguish between the direct effect

and the indirect transmission effect of VFI on Teffort, all variables are standardized, and the 3SLS method is used for re-estimation. The regression results are presented in Table 4.17.

Table 4.17: Results of Standardized Regressions on Quality, Teffort, and Gstructure

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-0.225** (-2.337)	-0.057*** (-3.235)	0.087*** (6.635)	-0.268*** (-2.970)	-0.061*** (-3.657)	0.085*** (6.977)
Teffort	-0.038** (-2.319)			-0.045*** (-2.933)		
Gstructure	0.110*** (3.899)			0.193*** (7.365)		
Open	-0.505*** (-10.566)			-0.483*** (-10.789)		
Ind	-0.101* (-1.726)			-0.082 (-1.511)		
Gscale	0.278*** (4.135)			0.316*** (5.040)		
Compete		0.014** (2.262)	-0.008** (-2.311)		0.014** (2.337)	-0.007** (-2.308)
Transfer		-0.017*** (-3.014)	0.017*** (5.622)		-0.019*** (-3.480)	0.022*** (7.534)
Urban		0.115*** (6.501)	0.005 (0.565)		0.116*** (6.937)	-0.000 (-0.005)
Density		-0.937*** (-12.144)	-0.095** (-2.283)		-0.923*** (-12.699)	-0.108*** (-2.790)
Ptax		0.692*** (29.240)			0.683*** (30.732)	
Pgdp		-0.840*** (-32.560)	0.011 (1.035)		-0.836*** (-34.438)	0.019* (1.887)
Fss			0.072*** (5.739)			0.070*** (6.041)
Capital			-0.005 (-1.182)			-0.003 (-0.955)
D	2.050*** (20.692)	0.478*** (9.985)	-0.075*** (-3.019)	2.057*** (22.151)	0.489*** (10.837)	-0.091*** (-3.920)
Constant	4.002*** (13.420)	1.700*** (15.827)	0.852*** (14.899)	3.767*** (13.513)	1.674*** (16.547)	0.883*** (16.644)
Region	Y	Y	Y	Y	Y	Y

Table 4.17 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Time	Y	Y	Y	Y	Y	Y
R ²	0.9614	0.8005	0.8078	0.9604	0.8004	0.8063
Adjust R ²	0.9608	0.7969	0.8039	0.9598	0.7968	0.8023
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-3.190*** (-16.383)	0.011 (0.527)	-0.102*** (-7.437)	-2.990*** (-16.449)	0.011 (0.574)	-0.105*** (-8.239)
Hebei	-5.745*** (-16.080)	-0.365*** (-4.399)	-0.136*** (-2.701)	-5.557*** (-16.646)	-0.352*** (-4.510)	-0.155*** (-3.328)
Shanxi	-5.721*** (-16.355)	-1.066*** (-9.599)	-0.188*** (-2.975)	-5.542*** (-16.971)	-1.046*** (-9.993)	-0.211*** (-3.597)
Inner Mongolia	-5.297*** (-15.645)	-2.556*** (-10.317)	-0.432*** (-3.160)	-4.996*** (-15.797)	-2.509*** (-10.753)	-0.482*** (-3.806)
Liaoning	-4.879*** (-15.509)	-0.784*** (-8.527)	-0.151*** (-2.785)	-4.745*** (-16.158)	-0.768*** (-8.873)	-0.170*** (-3.373)
Jilin	-5.234*** (-14.628)	-1.260*** (-9.063)	-0.226*** (-2.909)	-5.014*** (-14.982)	-1.234*** (-9.423)	-0.256*** (-3.542)
Heilongjiang	-5.358*** (-13.009)	-1.556*** (-9.000)	-0.277*** (-2.940)	-5.112*** (-13.284)	-1.526*** (-9.372)	-0.308*** (-3.520)
Shanghai	-1.152*** (-8.703)	0.760*** (11.153)	0.000 (0.008)	-0.978*** (-7.885)	0.747*** (11.632)	0.013 (0.377)
Jiangsu	-4.130*** (-16.428)	0.242*** (6.245)	-0.070*** (-2.940)	-3.974*** (-16.948)	0.242*** (6.642)	-0.080*** (-3.621)
Zhejiang	-4.144*** (-16.857)	-0.169*** (-3.234)	-0.058* (-1.807)	-4.048*** (-17.651)	-0.164*** (-3.334)	-0.069** (-2.299)
Anhui	-5.509*** (-15.471)	-0.283*** (-3.610)	-0.148*** (-3.183)	-5.289*** (-15.892)	-0.270*** (-3.663)	-0.168*** (-3.892)
Fujian	-5.005*** (-16.428)	-0.283*** (-3.298)	-0.182*** (-3.536)	-4.802*** (-16.891)	-0.271*** (-3.354)	-0.203*** (-4.255)
Jiangxi	-5.757*** (-15.005)	-0.705*** (-6.848)	-0.181*** (-3.065)	-5.537*** (-15.452)	-0.687*** (-7.084)	-0.204*** (-3.736)
Shandong	-5.113*** (-16.892)	0.130** (2.366)	-0.098*** (-2.763)	-4.959*** (-17.551)	0.134*** (2.589)	-0.112*** (-3.420)
Henan	-5.828*** (-14.701)	0.296*** (4.363)	-0.096** (-2.366)	-5.655*** (-15.266)	0.302*** (4.723)	-0.114*** (-3.024)
Hubei	-5.290*** (-14.868)	-0.290*** (-3.178)	-0.166*** (-3.148)	-5.102*** (-15.342)	-0.275*** (-3.203)	-0.188*** (-3.850)

Table 4.17 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Hunan	-5.529*** (-15.168)	-0.212** (-2.264)	-0.163*** (-3.018)	-5.329*** (-15.635)	-0.199** (-2.252)	-0.185*** (-3.695)
Guangdong	-3.613*** (-15.156)	-0.287*** (-6.159)	-0.046 (-1.616)	-3.579*** (-16.089)	-0.282*** (-6.434)	-0.052** (-1.989)
Guangxi	-5.896*** (-15.360)	-0.865*** (-7.202)	-0.167** (-2.481)	-5.722*** (-15.943)	-0.844*** (-7.462)	-0.194*** (-3.100)
Hainan	-5.348*** (-16.824)	-1.179*** (-11.380)	-0.197*** (-3.544)	-5.177*** (-17.416)	-1.155*** (-11.845)	-0.219*** (-4.243)
Chongqing	-4.776*** (-15.726)	-0.415*** (-5.175)	-0.195*** (-4.121)	-4.541*** (-15.997)	-0.402*** (-5.324)	-0.213*** (-4.860)
Sichuan	-5.405*** (-14.789)	-0.975*** (-7.622)	-0.229*** (-3.178)	-5.169*** (-15.130)	-0.952*** (-7.903)	-0.256*** (-3.842)
Guizhou	-6.104*** (-15.860)	-1.306*** (-10.508)	-0.152** (-2.274)	-5.949*** (-16.533)	-1.281*** (-10.942)	-0.178*** (-2.868)
Yunnan	-5.752*** (-15.611)	-1.412*** (-9.370)	-0.220*** (-2.658)	-5.564*** (-16.147)	-1.383*** (-9.749)	-0.251*** (-3.268)
Shanxi	-5.494*** (-14.879)	-0.934*** (-7.696)	-0.192*** (-2.797)	-5.311*** (-15.400)	-0.911*** (-7.971)	-0.220*** (-3.455)
Gansu	-5.794*** (-14.031)	-1.803*** (-9.448)	-0.231** (-2.256)	-5.613*** (-14.535)	-1.769*** (-9.840)	-0.269*** (-2.833)
Qinghai	-5.326*** (-11.499)	-3.391*** (-10.987)	-0.389** (-2.407)	-5.136*** (-11.866)	-3.331*** (-11.458)	-0.450*** (-2.999)
Ningxia	-5.517*** (-14.342)	-1.641*** (-10.239)	-0.310*** (-3.623)	-5.193*** (-14.441)	-1.608*** (-10.652)	-0.344*** (-4.333)
Xinjiang	-5.508*** (-13.930)	-2.896*** (-10.621)	-0.388*** (-2.640)	-5.322*** (-14.406)	-2.843*** (-11.069)	-0.443*** (-3.252)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.081 (1.182)	0.010 (0.817)	-0.024*** (-3.605)	0.119* (1.850)	0.012 (1.014)	-0.025*** (-3.935)
2010.year	0.159** (2.021)	0.035** (2.357)	-0.052*** (-6.352)	0.246*** (3.326)	0.038*** (2.694)	-0.054*** (-6.965)
2011.year	0.310*** (3.950)	0.015 (0.776)	-0.065*** (-6.578)	0.398*** (5.378)	0.020 (1.075)	-0.067*** (-7.316)
2012.year	0.352*** (4.282)	-0.021 (-0.867)	-0.076*** (-6.382)	0.430*** (5.563)	-0.014 (-0.630)	-0.080*** (-7.226)
2013.year	0.408*** (4.748)	-0.014 (-0.508)	-0.067*** (-5.140)	0.452*** (5.598)	-0.006 (-0.244)	-0.072*** (-5.951)

Table 4.17 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2014.year	0.600*** (6.615)	0.004 (0.123)	-0.087*** (-6.168)	0.666*** (7.824)	0.012 (0.434)	-0.094*** (-7.138)
2015.year	0.748*** (7.813)	0.027 (0.864)	-0.092*** (-6.174)	0.819*** (9.109)	0.035 (1.212)	-0.100*** (-7.186)
2016.year	0.919*** (8.681)	0.088*** (2.659)	-0.098*** (-6.037)	0.997*** (10.040)	0.096*** (3.104)	-0.106*** (-7.030)
2017.year	1.121*** (10.391)	0.180*** (5.167)	-0.082*** (-4.639)	1.171*** (11.573)	0.188*** (5.745)	-0.091*** (-5.550)
2018.year	1.329*** (12.518)	0.241*** (6.277)	-0.078*** (-4.032)	1.367*** (13.731)	0.250*** (6.916)	-0.088*** (-4.885)
2019.year	1.694*** (15.499)	0.260*** (6.246)	-0.082*** (-3.894)	1.732*** (16.908)	0.270*** (6.887)	-0.093*** (-4.754)
2020.year	-0.021 (-0.296)	-0.113*** (-9.622)	-0.026*** (-4.266)	0.028 (0.416)	-0.113*** (-10.202)	-0.025*** (-4.303)
2021.year	-0.167** (-2.373)	-0.024** (-2.142)	-0.006 (-1.019)	-0.149** (-2.240)	-0.025** (-2.286)	-0.006 (-1.079)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Beijing and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

The standardized regression results indicate that the significance levels of each variable are consistent with those found in the benchmark regression. VFI and Teffort significantly inhibit improvements in Quality, whereas Gstructure significantly enhances Quality. Additionally, while VFI significantly enhances Gstructure, it simultaneously inhibits Teffort.

According to the standardized regression results in Table 4.17, this study calculates the direct, indirect, and total effects of VFI, Teffort, and Gstructure on Quality. The detailed results are shown in Table 4.18.

Table 4.18: Paths and Transmission Mechanisms of VFI on Quality

Mechanisms	Paths and Transmission	Effect	Result	Total Effect
Direct Effect	VFI → Quality	α_1	-2.525	2.294
Direct Effect	Teffort → Quality	α_2	-0.870	
Direct Effect	Gstructure → Quality	α_3	13.070	
Indirect Effect	VFI → Teffort	β_1	-0.312	
	VFI → Teffort → Quality	$\beta_1 \times \alpha_2$	0.271	
Indirect Effect	VFI → Gstructure	γ_1	0.348	
	VFI → Gstructure → Quality	$\gamma_1 \times \alpha_3$	4.548	

Note: ① The indirect effects are calculated by multiplying the coefficients of the direct effects. ② The total effect is calculated by adding the direct effect to the indirect effect.

Based on the calculations in Table 4.18, the direct effect of Teffort and Gstructure on Quality is -0.870 and 13.070, respectively. Summarizing the direct impact path of VFI on Quality, the direct negative effect of VFI on Quality is 2.525.

VFI has two indirect transmission mechanisms on Quality. The first mechanism is VFI indirectly positively affects Quality by inhibiting Teffort (Chu & Fei, 2021), with an indirect positive effect of 0.271. This result supports research hypothesis 4. The second mechanism is VFI indirectly positively affects Quality by optimizing Gstructure (Wei et al., 2021), with an indirect positive effect of 4.548. This result supports research hypothesis 7. Combining the direct and indirect effects, the total effect of VFI on Quality is 2.294.

4.4.2 Discussion on the Regional Results

- Descriptive Statistics

Table 4.19 presents the statistical characteristics of various economic variables across the eastern, central, and western regions, including sample size, standard error, minimum value, maximum value, and mean value. It is evident that for the dependent variable Quality, the eastern region has the highest average quality (0.6072) and the largest standard error (1.6214), indicating significant variability in quality in this region. The central and western regions have lower average quality values, at -0.4354 and -0.2903, respectively, indicating inferior performance in terms of quality compared to the eastern region.

Regarding core explanatory variables, for Teffort, the average values are similar across the three regions, all around 1, suggesting little regional variation in effort. The standard error is also small, indicating low variability of this variable within each region. For VFI, the western region has the highest average value (0.8096), while the eastern region has the lowest (0.4850). This suggests that the western region might rely more on higher fiscal transfers, whereas the eastern region may depend more on its own fiscal resources. For Gstructure, the average values are similar across the three regions, with little difference. However, the central region has the smallest standard error (0.0309), indicating a more stable government expenditure structure.

Regarding control variables, the average Open in the eastern region is significantly higher than in the other two regions (0.5962), reflecting a higher level of Open in the eastern

region. The central and western regions have lower Open, particularly the western region (0.1150). For Ind, the eastern region has a higher average value (0.5217), indicating a more optimized industrial structure. The western region follows (0.4622), and the central region has the lowest (0.4335).

For Gscale, the western region has the highest average value (0.3271), and the eastern region has the lowest (0.1832). This suggests greater government intervention in the western region. For Compete, the western region has the highest average value (4.6813) and the largest standard error (3.3365), indicating substantial variability in competitiveness. The central and eastern regions follow, with averages of 4.3625 and 2.2258, respectively.

For Transfer, the central and western regions have higher average values, at 0.5499 and 0.5466, respectively, with the eastern region having the lowest (0.3654). This indicates less reliance on fiscal transfers in the eastern region. For Urban, the eastern region has the highest rate (0.6760), reflecting a higher level of urbanization. The central and western regions have lower rates, at 0.5266 and 0.4945, respectively.

For Density, the eastern region has the highest density (6.4828), indicating a higher concentration of population. The central and western regions follow, with densities of 5.5204 and 4.3762, respectively. For Ptax, the eastern region has the highest per capita tax (8.8061), while the central and western regions have lower values, at 7.8568 and 7.9820, respectively. This indicates stronger tax revenue capacity in the eastern region.

For Pgdp, the eastern region has the highest value (4.0823), followed by the central (3.5391) and western (3.4666) regions, reflecting higher economic development in the eastern region. For Fss, the eastern region has the highest value (-0.3822), while the central and western regions have lower values, at -0.8868 and -1.0700, respectively. This indicates better Fss in the eastern region. For Capital, the western region has the highest average value (4.5218), suggesting more infrastructure investment in this region. The central and eastern regions follow, with values of 4.3994 and 3.5455, respectively.

The analysis shows that the eastern region performs better in several economic variables, including Quality, Open, Urban, Ptax, and Pgdp, reflecting a higher level of economic development. The central and western regions lag behind in some variables, particularly showing higher dependency on fiscal transfers and government intervention.

Table 4.19: Descriptive Statistics of Variables

Variable	Region	Sample Size	Standard Errors	Minimum	Maximum	Average
Quality	East	15×11	1.6214	-1.5900	7.5800	0.6072
	Center	15×8	0.7369	-1.7500	0.9500	-0.4354
	West	15×11	0.7802	-1.7200	1.7400	-0.2903
Teffort	East	15×11	0.0850	0.7678	1.2753	1.0009
	Center	15×8	0.0854	0.8701	1.3027	1.0058
	West	15×11	0.0925	0.8108	1.2544	1.0005
VFI	East	15×11	0.1754	0.1490	0.8085	0.4850
	Center	15×8	0.0556	0.6327	0.9073	0.7838
	West	15×11	0.0760	0.6156	0.9383	0.8096
Gstructure	East	15×11	0.0535	0.4274	0.7108	0.5978
	Center	15×8	0.0309	0.5539	0.7043	0.6179
	West	15×11	0.0474	0.4832	0.6707	0.5932
Open	East	15×11	0.3729	0.1089	1.6701	0.5962
	Center	15×8	0.0408	0.0480	0.2504	0.1205
	West	15×11	0.0713	0.0076	0.4009	0.1150

Table 4.19 continued

Variable	Region	Sample Size	Standard Errors	Minimum	Maximum	Average
Ind	East	15×11	0.1216	0.3406	0.8373	0.5217
	Center	15×8	0.0661	0.2979	0.5376	0.4335
	West	15×11	0.0470	0.3508	0.5531	0.4622
Gscale	East	15×11	0.0629	0.0969	0.3544	0.1832
	Center	15×8	0.0608	0.1262	0.3997	0.2254
	West	15×11	0.1233	0.1611	0.7583	0.3271
Compete	East	15×11	1.8992	0.4697	12.6683	2.2258
	Center	15×8	2.3769	1.7333	13.3901	4.3625
	West	15×11	3.3365	1.0692	17.1979	4.6813
Transfer	East	15×11	0.2141	0.0319	0.7528	0.3654
	Center	15×8	0.0763	0.3951	0.7089	0.5499
	West	15×11	0.0835	0.3171	0.7436	0.5466
Urban	East	15×11	0.1336	0.4025	0.8960	0.6760
	Center	15×8	0.0741	0.3434	0.6569	0.5266
	West	15×11	0.0955	0.2824	0.7032	0.4945
Density	East	15×11	0.7458	5.5185	8.2753	6.4828
Density	Center	15×8	0.6068	4.1907	6.3890	5.5204
	West	15×11	1.2050	2.0337	5.9656	4.3762
Ptax	East	15×11	0.7851	6.7918	10.4425	8.8061
	Center	15×8	0.6195	6.4697	9.1155	7.8568
	West	15×11	0.6515	6.3235	9.0884	7.9820
Pgdp	East	15×11	0.5240	2.6813	5.2338	4.0823
	Center	15×8	0.4470	2.5635	4.4534	3.5391
	West	15×11	0.5184	2.0592	4.4795	3.4666
Fss	East	15×11	0.2371	-1.0032	-0.0504	-0.3822
	Center	15×8	0.1853	-1.5536	-0.5275	-0.8868
	West	15×11	0.3117	-1.9088	-0.5419	-1.0700
Capital	East	15×11	1.2760	1.2962	7.2241	3.5455
	Center	15×8	1.1313	2.6154	8.9488	4.3994
	West	15×11	0.9053	3.2572	8.4633	4.5218

Note: Original data from China National Bureau of Statistics (2023), then calculated by the author using Stata 17.0.

● Analysis of Empirical Results

To better study the relationship between VFI and Quality in each region, this study adopts 2SLS and 3SLS to estimate the model respectively. The principle is the same as above, the specific estimation results are detailed in Table 4.20, Table 4.21 and Table 4.22.

Table 4.20: Benchmark Regression in Eastern Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-7.851*** (-3.061)	-0.593*** (-4.623)	0.672*** (4.691)	-9.413*** (-4.524)	-0.588*** (-5.098)	0.554*** (5.980)
Teffort	-4.454*** (-2.871)			-3.501*** (-3.356)		
Gstructure	35.957*** (3.596)			35.067*** (3.991)		
Open	-1.943*** (-3.350)			-1.881*** (-4.965)		
Ind	-15.039*** (-3.061)			-5.610 (-1.544)		
Gscale	38.508*** (3.493)			22.648*** (2.590)		
Compete		0.003 (0.693)	0.004 (1.586)		0.003 (0.755)	0.002 (1.358)
Transfer		-0.029 (-0.671)	0.064*** (2.853)		-0.029 (-0.743)	0.066*** (3.538)
Urban		0.815*** (4.500)	0.191* (1.682)		0.812*** (4.972)	0.054 (0.786)
Density		-0.304** (-2.406)	-0.181*** (-2.832)		-0.305*** (-2.686)	-0.147*** (-4.044)
Ptax		0.687*** (14.390)			0.690*** (16.149)	
Pgdp		-1.237*** (-14.754)	-0.049 (-1.459)		-1.238*** (-16.440)	-0.014 (-0.717)
Fss			0.384*** (3.737)			0.277*** (4.342)
Capital			0.001 (0.122)			-0.001 (-0.444)
D	2.495*** (3.452)	0.402*** (4.902)	0.059 (1.332)	2.094*** (4.330)	0.400*** (5.416)	0.016 (0.566)

Table 4.20 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Constant	-5.954 (-1.194)	1.458 (1.635)	1.814*** (3.850)	-10.640*** (-2.704)	1.454* (1.809)	1.577*** (5.835)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.8196	0.8042	0.8682	0.8325	0.8042	0.8711
Adjust R ²	0.8116	0.7942	0.8605	0.8250	0.7942	0.8636
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-5.042*** (-5.052)	0.058* (1.857)	-0.149*** (-6.257)	-1.998*** (-3.021)	0.058** (2.070)	-0.129*** (-7.738)
Hebei	-8.915*** (-4.795)	0.181 (1.062)	-0.321*** (-3.263)	-4.731*** (-3.492)	0.179 (1.167)	-0.275*** (-4.616)
Liaoning	-9.726*** (-5.010)	-0.128 (-0.675)	-0.349*** (-3.291)	-5.348*** (-3.581)	-0.130 (-0.763)	-0.287*** (-4.505)
Shanghai	-0.595 (-0.898)	0.281** (2.008)	0.112 (1.578)	0.742 (1.592)	0.283** (2.248)	0.079* (1.958)
Jiangsu	-5.572*** (-4.121)	0.381*** (5.547)	-0.140*** (-3.376)	-3.224*** (-3.808)	0.381*** (6.155)	-0.127*** (-5.145)
Zhejiang	-6.621*** (-4.757)	0.144 (1.363)	-0.175*** (-2.911)	-4.304*** (-4.475)	0.143 (1.504)	-0.146*** (-4.135)
Fujian	-6.039*** (-3.911)	0.264 (1.497)	-0.352*** (-3.609)	-3.139*** (-3.219)	0.262* (1.651)	-0.307*** (-5.349)
Shandong	-7.243*** (-4.602)	0.401*** (3.841)	-0.214*** (-3.348)	-4.273*** (-3.990)	0.400*** (4.256)	-0.186*** (-4.723)
Guangdong	-6.446*** (-4.426)	0.006 (0.062)	-0.162*** (-3.084)	-4.235*** (-4.093)	0.005 (0.061)	-0.127*** (-3.979)
Hainan	-10.717*** (-5.106)	-0.400* (-1.859)	-0.367*** (-3.359)	-5.514*** (-3.367)	-0.404** (-2.087)	-0.327*** (-5.024)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.239 (0.728)	0.027 (1.334)	-0.001 (-0.108)	0.381 (1.302)	0.027 (1.459)	-0.008 (-0.932)
2010.year	1.043** (1.987)	0.079*** (3.133)	-0.025* (-1.802)	1.376*** (3.160)	0.078*** (3.449)	-0.039*** (-3.642)
2011.year	1.321** (2.569)	0.052* (1.672)	-0.031* (-1.818)	1.656*** (3.831)	0.051* (1.824)	-0.045*** (-3.710)

Table 4.20 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2012.year	1.007** (1.997)	0.015 (0.385)	-0.027 (-1.255)	1.473*** (3.611)	0.014 (0.390)	-0.045*** (-3.140)
2013.year	0.295 (0.581)	0.014 (0.324)	-0.002 (-0.081)	0.768** (2.005)	0.013 (0.323)	-0.025 (-1.557)
2014.year	0.981* (1.653)	0.031 (0.639)	-0.012 (-0.475)	1.370*** (3.068)	0.029 (0.674)	-0.038** (-2.209)
2015.year	1.187* (1.869)	0.044 (0.870)	-0.009 (-0.337)	1.450*** (3.053)	0.043 (0.932)	-0.036** (-2.007)
2016.year	1.873** (2.291)	0.116** (2.046)	-0.022 (-0.738)	2.289*** (3.776)	0.114** (2.239)	-0.054*** (-2.749)
2017.year	1.527* (1.943)	0.186*** (3.094)	0.007 (0.223)	1.780*** (3.258)	0.184*** (3.404)	-0.026 (-1.250)
2018.year	1.812** (2.331)	0.236*** (3.588)	0.018 (0.510)	1.874*** (3.489)	0.234*** (3.953)	-0.016 (-0.730)
2019.year	2.306*** (2.903)	0.258*** (3.633)	0.027 (0.710)	2.314*** (4.250)	0.256*** (4.003)	-0.011 (-0.454)
2020.year	0.360 (0.949)	-0.066*** (-3.349)	-0.040*** (-3.943)	0.694** (2.093)	-0.066*** (-3.723)	-0.037*** (-4.308)
2021.year	-0.381 (-1.112)	-0.010 (-0.496)	-0.010 (-0.977)	-0.096 (-0.323)	-0.010 (-0.548)	-0.010 (-1.182)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1% ,5% and 10% significance levels, respectively.

Table 4.21: Benchmark Regression in Central Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-1.287** (-2.406)	-0.173 (-0.690)	0.239 (1.143)	-1.349*** (-3.038)	-0.426** (-2.033)	0.189 (1.094)
Teffort	-0.585*** (-3.316)			-0.667*** (-4.725)		
Gstructure	2.914*** (3.111)			3.216*** (4.116)		
Open	0.152 (0.356)			0.366 (1.122)		

Table 4.21 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Ind	1.315*** (2.727)			1.614*** (4.208)		
Gscale	1.833** (2.198)			1.819*** (2.701)		
Compete		-0.001 (-0.211)	-0.004** (-2.437)		-0.007** (-2.290)	-0.002 (-1.126)
Transfer		-0.370 (-1.517)	0.088 (0.830)		-0.152 (-0.789)	0.043 (0.504)
Urban		1.663*** (3.879)	0.210 (1.106)		1.434*** (4.200)	0.205 (1.342)
Density		-1.640*** (-7.873)	-0.205** (-2.025)		-1.518*** (-8.793)	-0.217*** (-2.598)
Ptax		0.979*** (14.332)			0.945*** (16.454)	
Pgdp		-1.582*** (-15.624)	0.100*** (3.012)		-1.656*** (-19.307)	0.152*** (5.526)
Fss			0.080 (1.088)			0.055 (0.923)
Capital			0.013** (2.251)			0.019*** (4.246)
Constant	-2.664*** (-3.104)	6.879*** (7.590)	1.221*** (2.891)	-2.869*** (-4.115)	6.880*** (9.155)	1.134*** (3.252)
D	1.872*** (23.450)	0.253* (1.712)	-0.224*** (-3.670)	1.852*** (27.592)	0.390*** (3.214)	-0.273*** (-5.400)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9896	0.8422	0.8280	0.9903	0.8786	0.8381
Adjust R ²	0.9890	0.8308	0.8139	0.9897	0.8699	0.8249
Shanxi	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Jilin	0.290*** (4.146)	-0.641*** (-5.613)	-0.163*** (-3.065)	0.273*** (4.634)	-0.552*** (-5.844)	-0.190*** (-4.311)
Heilongjiang	0.371*** (3.574)	-1.494*** (-6.172)	-0.260** (-2.288)	0.382*** (4.596)	-1.335*** (-6.688)	-0.274*** (-2.925)
Anhui	0.069 (0.930)	1.473*** (9.506)	0.130* (1.838)	0.060 (0.960)	1.404*** (10.929)	0.128** (2.199)
Jiangxi	-0.070 (-1.023)	0.599*** (11.208)	0.034 (1.448)	-0.068 (-1.207)	0.585*** (13.126)	0.030 (1.563)

Table 4.21 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Henan	-0.117 (-0.967)	2.370*** (9.954)	0.228** (2.149)	-0.115 (-1.166)	2.232*** (11.338)	0.239*** (2.749)
Hubei	0.309*** (3.206)	1.112*** (14.440)	0.050 (1.545)	0.299*** (3.812)	1.090*** (16.855)	0.049* (1.843)
Hunan	0.098 (0.937)	1.251*** (13.238)	0.077** (1.969)	0.094 (1.103)	1.215*** (15.417)	0.081** (2.503)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.133*** (2.780)	-0.031 (-1.333)	-0.032*** (-3.284)	0.142*** (3.452)	-0.004 (-0.185)	-0.036*** (-4.390)
2010.year	0.320*** (4.854)	-0.045 (-1.510)	-0.066*** (-5.172)	0.339*** (6.154)	-0.008 (-0.303)	-0.073*** (-6.886)
2011.year	0.400*** (4.692)	-0.102** (-2.426)	-0.100*** (-6.057)	0.419*** (5.987)	-0.044 (-1.261)	-0.112*** (-8.127)
2012.year	0.401*** (4.394)	-0.169*** (-2.888)	-0.116*** (-5.181)	0.413*** (5.596)	-0.099** (-2.025)	-0.131*** (-7.001)
2013.year	0.443*** (5.009)	-0.196*** (-2.934)	-0.113*** (-4.471)	0.446*** (6.196)	-0.131** (-2.359)	-0.128*** (-6.036)
2014.year	0.627*** (6.139)	-0.194** (-2.477)	-0.146*** (-4.854)	0.631*** (7.594)	-0.127* (-1.951)	-0.164*** (-6.543)
2015.year	0.766*** (6.945)	-0.184** (-2.168)	-0.165*** (-4.966)	0.767*** (8.509)	-0.112 (-1.588)	-0.188*** (-6.765)
2016.year	0.950*** (8.179)	-0.141 (-1.538)	-0.179*** (-4.978)	0.948*** (9.979)	-0.055 (-0.725)	-0.207*** (-6.915)
2017.year	1.150*** (10.560)	-0.038 (-0.374)	-0.185*** (-4.555)	1.142*** (12.758)	0.053 (0.635)	-0.217*** (-6.433)
2018.year	1.311*** (13.177)	0.021 (0.187)	-0.196*** (-4.331)	1.302*** (15.797)	0.127 (1.374)	-0.232*** (-6.176)
2019.year	1.531*** (14.928)	0.022 (0.175)	-0.208*** (-4.190)	1.514*** (17.787)	0.138 (1.354)	-0.248*** (-6.012)
2020.year	-0.010 (-0.184)	-0.118*** (-4.903)	-0.012 (-1.137)	0.001 (0.012)	-0.131*** (-6.430)	-0.006 (-0.627)
2021.year	-0.052 (-1.083)	-0.006 (-0.308)	-0.004 (-0.327)	-0.045 (-1.090)	-0.022 (-1.249)	0.001 (0.078)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively.

Table 4.22: Benchmark Regression in Western Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	0.977 (1.538)	-0.055 (-0.403)	0.564*** (2.597)	0.954* (1.666)	-0.083 (-0.675)	0.441** (2.291)
Teffort	0.396*** (2.629)			0.433*** (3.222)		
Gstructure	-0.033 (-0.025)			0.053 (0.046)		
Open	0.756*** (2.965)			0.953*** (4.242)		
Ind	-0.336 (-0.421)			-0.638 (-0.904)		
Gscale	0.133 (0.182)			0.277 (0.427)		
Compete		0.014*** (6.633)	-0.006*** (-3.012)		0.013*** (6.901)	-0.008*** (-4.205)
Transfer		-0.273*** (-4.335)	0.317*** (5.303)		-0.268*** (-4.748)	0.331*** (6.238)
Urban		2.732*** (9.820)	0.012 (0.045)		2.566*** (10.328)	-0.172 (-0.718)
Density		-1.448*** (-15.892)	0.146* (1.691)		-1.424*** (-17.476)	0.182** (2.377)
Ptax		0.966*** (28.755)			0.965*** (32.085)	
Pgdp		-1.567*** (-32.923)	0.006 (0.151)		-1.570*** (-36.698)	-0.006 (-0.152)
Fss			0.222*** (3.243)			0.189*** (3.126)
Capital			-0.014** (-2.218)			-0.016*** (-2.934)
D	1.959*** (22.254)	0.149** (2.307)	-0.131** (-2.212)	1.980*** (25.125)	0.183*** (3.166)	-0.094* (-1.805)
Constant	-2.159** (-2.487)	1.847*** (4.993)	-0.135 (-0.442)	-2.151*** (-2.758)	1.894*** (5.739)	-0.033 (-0.121)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9792	0.9390	0.7942	0.9792	0.9392	0.7964
Adjust R ²	0.9783	0.9359	0.7823	0.9783	0.9361	0.7846
Inner Mongolia	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Table 4.22 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Guangxi	-1.002*** (-6.815)	3.563*** (16.472)	-0.261 (-1.273)	-1.025*** (-7.749)	3.492*** (18.046)	-0.362** (-1.992)
Chongqing	0.133* (1.805)	4.235*** (16.136)	-0.411 (-1.643)	0.119* (1.801)	4.165*** (17.736)	-0.517** (-2.339)
Sichuan	-0.428*** (-4.680)	3.326*** (16.574)	-0.285 (-1.491)	-0.439*** (-5.328)	3.257*** (18.141)	-0.383** (-2.266)
Guizhou	-0.684*** (-4.127)	3.164*** (14.294)	-0.247 (-1.174)	-0.687*** (-4.630)	3.086*** (15.592)	-0.358* (-1.928)
Yunnan	-0.618*** (-5.045)	2.701*** (15.565)	-0.189 (-1.142)	-0.623*** (-5.652)	2.632*** (16.959)	-0.285* (-1.948)
Shanxi	-0.287** (-2.410)	3.327*** (16.257)	-0.263 (-1.347)	-0.303*** (-2.838)	3.265*** (17.831)	-0.353** (-2.048)
Gansu	-0.530*** (-2.698)	1.788*** (16.088)	-0.037 (-0.348)	-0.545*** (-3.095)	1.742*** (17.517)	-0.106 (-1.132)
Qianghai	0.422 (1.593)	-1.399*** (-16.000)	0.258*** (3.032)	0.396* (1.679)	-1.386*** (-17.701)	0.264*** (3.514)
Ningxia	-0.342*** (-3.706)	2.093*** (14.122)	-0.242* (-1.714)	-0.351*** (-4.226)	2.052*** (15.485)	-0.307** (-2.457)
Xinjiang	-0.385** (-2.288)	-0.401*** (-9.758)	0.094** (2.470)	-0.425*** (-2.823)	-0.411*** (-11.161)	0.079** (2.375)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.087 (1.455)	-0.036** (-2.529)	-0.031** (-2.301)	0.087 (1.612)	-0.033*** (-2.591)	-0.030** (-2.505)
2010.year	0.304*** (4.100)	-0.041** (-2.398)	-0.050*** (-2.921)	0.311*** (4.655)	-0.036** (-2.370)	-0.049*** (-3.232)
2011.year	0.391*** (5.997)	-0.100*** (-4.168)	-0.057*** (-2.619)	0.389*** (6.605)	-0.092*** (-4.269)	-0.052*** (-2.698)
2012.year	0.497*** (7.062)	-0.159*** (-5.115)	-0.082*** (-3.132)	0.491*** (7.740)	-0.149*** (-5.346)	-0.075*** (-3.217)
2013.year	0.673*** (9.019)	-0.157*** (-4.506)	-0.094*** (-3.181)	0.663*** (9.912)	-0.146*** (-4.692)	-0.086*** (-3.319)
2014.year	0.861*** (10.556)	-0.163*** (-4.212)	-0.121*** (-3.778)	0.857*** (11.678)	-0.150*** (-4.335)	-0.111*** (-3.896)
2015.year	1.023*** (11.380)	-0.163*** (-3.929)	-0.128*** (-3.690)	1.019*** (12.617)	-0.148*** (-3.977)	-0.114*** (-3.710)

Table 4.22 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2016.year	1.252*** (13.540)	-0.133*** (-3.061)	-0.115*** (-3.075)	1.257*** (15.143)	-0.114*** (-2.947)	-0.097*** (-2.936)
2017.year	1.472*** (16.581)	-0.054 (-1.161)	-0.102** (-2.477)	1.486*** (18.669)	-0.032 (-0.772)	-0.080** (-2.205)
2018.year	1.596*** (18.161)	-0.023 (-0.455)	-0.101** (-2.212)	1.616*** (20.512)	0.002 (0.042)	-0.075* (-1.848)
2019.year	1.858*** (18.983)	-0.034 (-0.600)	-0.112** (-2.253)	1.882*** (21.478)	-0.006 (-0.113)	-0.083* (-1.883)
2020.year	0.134** (2.136)	-0.092*** (-7.316)	-0.014 (-1.202)	0.139** (2.461)	-0.095*** (-8.430)	-0.020* (-1.838)
2021.year	-0.071 (-1.246)	-0.008 (-0.677)	-0.004 (-0.341)	-0.068 (-1.323)	-0.010 (-0.891)	-0.008 (-0.756)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively.

Table 4.20 presents the regression results for the eastern region. Compared to the nationwide regression results in Table 4.14, the model fit has improved, indicating better goodness-of-fit for each equation. The coefficients and significance of the core explanatory variables have not changed significantly. For instance, the regression coefficient of vertical fiscal imbalance on expenditure structure in the eastern region is 0.554, higher than the national average of 0.348. The absolute values of the regression coefficients in the eastern region are all higher than the national levels, suggesting that the impact of VFI, Teffort, and Gstructure on Quality is greater in the eastern region than nationwide. Additionally, the influence of vertical fiscal imbalance on tax effort and expenditure structure is slightly higher in the eastern region than at the national level. Other control variables, such as compete, Pgdp, and Covid-19, have turned from significant to insignificant in their impact on

Gstructure, indicating that horizontal competition among provinces, economic development levels, and the Covid-19 pandemic have no significant impact on the eastern region's expenditure structure.

Table 4.21 presents the regression results for the central region. The model fit exceeds 80% in the central region, indicating good goodness-of-fit for each equation. Among the core explanatory variables, only the influence of VFI on Gstructure has become insignificant, indicating that an increase in VFI does not significantly impact the optimization of Gstructure in the central region. The coefficients and significance of other core explanatory variables have not changed significantly compared to the national level. The absolute values of the regression coefficients in the central region are all smaller than the national levels, indicating that the impact of VFI, Teffort, and Gstructure on Quality is lower in the central region than nationwide.

Additionally, the influence of VFI on Teffort is slightly lower in the central region than at the national level. Among the control variables, it is noteworthy that the impact of Ind on Quality is significantly positive, indicating that optimizing and updating the industrial structure can promote the advancement of Quality in the central region. By developing the tertiary industry, local governments can not only increase employment and income levels for local residents but also help to transition the economy away from reliance on the secondary industry. Thus, improving the service industry level in the tertiary sector has the potential to continually increase quality.

Table 4.22 presents the regression results for the western region. The goodness-of-fit for the equations on Quality and Teffort exceeds 90%, and for the Gstructure equation, it exceeds 78%, indicating good model fit for each equation. Among the core explanatory variables, the impact of VFI on Quality is significantly positive, suggesting that an increase in VFI promotes the improvement of Quality in the western region. This is closely related to the economic development level and geographical location of the western region. Compared to the eastern and central regions, the western region is economically less developed, and local government funding primarily relies on central government transfer payments redistributed to the western region. These funds can be used for infrastructure construction, education, healthcare, and other public services, promoting local economic development and improving residents' quality of life.

Another core explanatory variable, Teffort, also has a significantly positive impact on Quality, indicating that maximizing tax revenue collection is beneficial for improving Quality in the western region. The third core explanatory variable, Gstructure, does not significantly affect Quality, indicating that the optimization of Gstructure does not significantly impact the improvement of Quality in the western region. Among the control variables, it is noteworthy that the impact of Gscale on Gstructure is no longer significant in the western region, indicating that an increase in Gscale does not significantly affect the optimization of Gstructure.

From the perspective of local economic structure, the eastern region is more economically developed and has a higher degree of marketization. The tax effort of local

governments is likely to have a greater impact on corporate investment decisions and industrial structure adjustments, thereby exerting a more significant influence on Quality. In contrast, in the central and western regions, where the industrial structure is still dominated by resource-based or traditional manufacturing industries, the marginal effect of tax effort is relatively small and may even be negative in certain cases.

From the perspective of government function distribution, local governments in the eastern region have a more optimized fiscal expenditure structure, particularly in areas such as infrastructure, public services, and technological innovation. As a result, expenditure structure plays a more significant role in promoting Quality. However, in the central and western regions, especially in the western region, fiscal expenditures are primarily allocated to basic public welfare and traditional infrastructure construction, which may not effectively translate into a driving force for Quality, leading to a weaker or even insignificant impact of expenditure structure.

- Robustness Test

The structure of public expenditure is measured by the share of livelihood expenditures to general government budget expenditures, and livelihood expenditures are composed of a combination of detailed types of expenditures, so this study conducts a robustness test by changing the measurement method of public expenditure structure. In this study, the livelihood expenditure is split into two parts, one is the protection expenditure, including four categories of general public service expenditure, general public security

expenditure, social security and employment expenditure and housing security expenditure. The other is the enhancement expenditure, including four categories of science and technology expenditure, education expenditure, culture, sports and media expenditure, and medical health and family planning expenditure. The public expenditure structure is expressed by the proportion of security expenditure in general public budget expenditure, and 3SLS regression is performed again. Table 4.23 to 4.25 shows the specific results. It is clear that the coefficients of the explanatory and interpreted variables and the control variables are still significant and the signs of the main variables have not changed, which indicates that the empirical results of 4.4.2.2 are stable.

Table 4.23: Robustness Test Regression Results of Eastern Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-9.511*** (-5.138)	-0.593*** (-4.623)	0.733*** (7.163)	-9.083*** (-5.773)	-0.552*** (-4.806)	0.677*** (8.384)
Teffort	-2.605*** (-3.056)			-2.650*** (-4.097)		
Gstructure	22.081*** (4.977)			19.773*** (5.193)		
Open	-1.667*** (-4.614)			-1.682*** (-6.061)		
Ind	-10.527*** (-3.978)			-4.908** (-2.557)		
Gscale	15.019*** (3.639)			12.661*** (4.060)		
Compete		0.003 (0.693)	0.002 (1.072)		0.003 (0.740)	0.001 (0.965)
Transfer		-0.029 (-0.671)	0.020 (1.235)		0.003 (0.085)	0.062*** (5.610)
Urban		0.815*** (4.500)	-0.055 (-0.674)		0.827*** (5.111)	-0.069 (-1.138)

Table 4.23 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Density		-0.304** (-2.406)	-0.232*** (-5.098)		-0.308*** (-2.739)	-0.207*** (-5.923)
Ptax		0.687*** (14.390)			0.705*** (16.604)	
Pgdp		-1.237*** (-14.754)	-0.071*** (-2.944)		-1.240*** (-16.584)	-0.045** (-2.505)
Fss			0.365*** (4.976)			0.310*** (5.313)
Capital			-0.001 (-0.274)			-0.002 (-0.904)
D	4.022*** (7.035)	0.402*** (4.902)	0.097*** (3.057)	3.282*** (7.287)	0.360*** (4.930)	0.038 (1.521)
Constant	7.708*** (4.553)	1.458 (1.635)	2.156*** (6.406)	4.667*** (3.587)	1.320* (1.659)	1.894*** (7.189)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9384	0.8042	0.9259	0.9418	0.8030	0.9205
Adjust R ²	0.9357	0.7942	0.9216	0.9392	0.7929	0.9159
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-4.896*** (-8.017)	0.058* (1.857)	-0.116*** (-6.812)	-3.513*** (-7.903)	0.059** (2.109)	-0.106*** (-7.904)
Hebei	-6.259*** (-6.305)	0.181 (1.062)	-0.487*** (-6.925)	-4.317*** (-5.773)	0.184 (1.210)	-0.440*** (-7.985)
Liaoning	-8.238*** (-7.602)	-0.128 (-0.675)	-0.409*** (-5.412)	-6.097*** (-7.447)	-0.131 (-0.774)	-0.360*** (-6.061)
Shanghai	-2.564*** (-6.245)	0.281** (2.008)	0.240*** (4.737)	-1.754*** (-5.715)	0.288** (2.313)	0.213*** (5.511)
Jiangsu	-5.679*** (-6.782)	0.381*** (5.547)	-0.211*** (-7.135)	-3.941*** (-6.437)	0.390*** (6.358)	-0.189*** (-7.989)
Zhejiang	-5.445*** (-6.965)	0.144 (1.363)	-0.300*** (-6.966)	-3.815*** (-6.663)	0.153 (1.619)	-0.264*** (-7.687)
Fujian	-5.287*** (-5.732)	0.264 (1.497)	-0.508*** (-7.291)	-3.467*** (-5.099)	0.265* (1.689)	-0.465*** (-8.435)
Shandong	-5.801*** (-6.482)	0.401*** (3.841)	-0.354*** (-7.730)	-3.995*** (-6.046)	0.409*** (4.378)	-0.320*** (-8.662)
Guangdong	-5.234*** (-6.470)	0.006 (0.062)	-0.270*** (-7.197)	-3.641*** (-6.102)	0.013 (0.157)	-0.236*** (-7.597)

Table 4.23 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Hainan	-6.745*** (-7.030)	-0.400* (-1.859)	-0.521*** (-6.669)	-5.006*** (-6.863)	-0.413** (-2.150)	-0.479*** (-7.848)
2009.year	0.397* (1.878)	0.027 (1.334)	-0.003 (-0.332)	0.363* (1.921)	0.023 (1.267)	-0.008 (-1.173)
2010.year	1.213*** (3.292)	0.079*** (3.133)	-0.024** (-2.448)	1.042*** (3.307)	0.071*** (3.148)	-0.036*** (-4.201)
2011.year	1.481*** (4.110)	0.052* (1.672)	-0.020 (-1.602)	1.299*** (4.183)	0.040 (1.433)	-0.034*** (-3.429)
2012.year	1.533*** (3.963)	0.015 (0.385)	-0.015 (-0.972)	1.334*** (4.010)	-0.002 (-0.060)	-0.034*** (-2.828)
2013.year	1.561*** (3.681)	0.014 (0.324)	-0.004 (-0.234)	1.300*** (3.616)	-0.005 (-0.140)	-0.028** (-2.038)
2014.year	1.905*** (3.980)	0.031 (0.639)	-0.000 (-0.017)	1.552*** (3.864)	0.008 (0.192)	-0.028* (-1.882)
2015.year	2.080*** (4.089)	0.044 (0.870)	0.006 (0.289)	1.664*** (3.930)	0.020 (0.447)	-0.025 (-1.562)
2016.year	2.683*** (4.270)	0.116** (2.046)	0.005 (0.245)	2.160*** (4.160)	0.089* (1.764)	-0.029* (-1.684)
2017.year	2.604*** (4.367)	0.186*** (3.094)	0.040* (1.740)	2.028*** (4.209)	0.158*** (2.945)	0.003 (0.143)
2018.year	2.944*** (4.947)	0.236*** (3.588)	0.052** (2.057)	2.305*** (4.827)	0.206*** (3.513)	0.012 (0.606)
2019.year	3.465*** (5.737)	0.258*** (3.633)	0.065** (2.410)	2.790*** (5.778)	0.225*** (3.554)	0.022 (1.000)
2020.year	0.134 (0.611)	-0.066*** (-3.349)	-0.033*** (-4.645)	0.119 (0.608)	-0.065*** (-3.671)	-0.030*** (-4.777)
2021.year	-0.106 (-0.505)	-0.010 (-0.496)	-0.011 (-1.443)	-0.128 (-0.685)	-0.010 (-0.568)	-0.012* (-1.824)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Beijing and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

Table 4.24: Robustness Test Regression Results of Central Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-1.680*** (-3.212)	-0.173 (-0.690)	-0.171 (-1.005)	-1.727*** (-3.871)	-0.483** (-2.352)	-0.117 (-0.831)
Teffort	-0.786*** (-4.679)			-0.857*** (-5.984)		
Gstructure	-0.404 (-0.457)			0.034 (0.048)		
Open	0.256 (0.596)			0.509 (1.502)		
Ind	1.549*** (3.208)			1.481*** (3.886)		
Gscale	1.868** (2.043)			1.922*** (2.646)		
Compete		-0.001 (-0.211)	-0.002 (-1.185)		-0.006* (-1.764)	-0.002 (-1.391)
Transfer		-0.370 (-1.517)	0.039 (0.452)		-0.172 (-0.899)	0.046 (0.617)
Urban		1.663*** (3.879)	-0.053 (-0.340)		1.225*** (3.654)	-0.073 (-0.548)
Density		-1.640*** (-7.873)	-0.297*** (-3.585)		-1.399*** (-8.245)	-0.317*** (-4.485)
Ptax		0.979*** (14.332)			0.947*** (17.057)	
Pgdp		-1.582*** (-15.624)	-0.013 (-0.493)		-1.683*** (-19.906)	-0.005 (-0.215)
Fss			-0.027 (-0.461)			0.003 (0.071)
Capital			0.006 (1.208)			0.009** (2.485)
D	1.731*** (17.981)	0.253* (1.712)	-0.051 (-1.024)	1.767*** (22.250)	0.478*** (4.050)	-0.052 (-1.198)
Constant	-0.179 (-0.330)	6.879*** (7.590)	2.139*** (6.209)	-0.263 (-0.589)	6.432*** (8.531)	2.194*** (7.394)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9901	0.8786	0.9039	0.9899	0.8709	0.9030
Adjust R ²	0.9895	0.8699	0.8960	0.9893	0.8616	0.8951
Shanxi	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Table 4.24 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Jilin	0.238*** (3.432)	-0.641*** (-5.613)	-0.138*** (-3.181)	0.230*** (3.863)	-0.481*** (-5.244)	-0.152*** (-4.095)
Heilongjiang	0.352*** (3.373)	-1.494*** (-6.172)	-0.289*** (-3.120)	0.326*** (3.788)	-1.186*** (-6.082)	-0.304*** (-3.827)
Anhui	0.055 (0.727)	1.473*** (9.506)	0.173*** (3.010)	0.066 (1.026)	1.317*** (10.432)	0.184*** (3.720)
Jiangxi	-0.074 (-1.017)	0.599*** (11.208)	0.030 (1.599)	-0.072 (-1.172)	0.558*** (12.678)	0.033** (2.014)
Henan	0.046 (0.404)	2.370*** (9.954)	0.290*** (3.352)	0.052 (0.550)	2.111*** (10.904)	0.306*** (4.121)
Hubei	0.387*** (3.710)	1.112*** (14.440)	0.128*** (4.837)	0.388*** (4.590)	1.068*** (16.593)	0.135*** (5.980)
Hunan	0.177 (1.628)	1.251*** (13.238)	0.126*** (3.941)	0.186** (2.087)	1.176*** (15.121)	0.134*** (4.886)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.054 (1.060)	-0.031 (-1.333)	-0.017** (-2.127)	0.064 (1.466)	0.004 (0.192)	-0.014** (-2.041)
2010.year	0.155* (1.953)	-0.045 (-1.510)	-0.041*** (-3.929)	0.184*** (2.833)	0.006 (0.239)	-0.036*** (-4.027)
2011.year	0.170* (1.896)	-0.102** (-2.426)	-0.041*** (-3.055)	0.191*** (2.627)	-0.024 (-0.713)	-0.037*** (-3.141)
2012.year	0.177* (1.655)	-0.169*** (-2.888)	-0.050*** (-2.736)	0.198** (2.290)	-0.070 (-1.479)	-0.046*** (-2.912)
2013.year	0.279** (2.374)	-0.196*** (-2.934)	-0.058*** (-2.799)	0.302*** (3.190)	-0.094* (-1.751)	-0.055*** (-3.052)
2014.year	0.407*** (3.343)	-0.194** (-2.477)	-0.061** (-2.492)	0.432*** (4.400)	-0.084 (-1.334)	-0.059*** (-2.777)
2015.year	0.516*** (3.995)	-0.184** (-2.168)	-0.072*** (-2.645)	0.545*** (5.228)	-0.065 (-0.946)	-0.071*** (-3.010)
2016.year	0.691*** (4.877)	-0.141 (-1.538)	-0.076** (-2.589)	0.729*** (6.389)	-0.002 (-0.025)	-0.075*** (-2.946)
2017.year	0.921*** (6.817)	-0.038 (-0.374)	-0.071** (-2.145)	0.962*** (8.804)	0.112 (1.387)	-0.071** (-2.463)
2018.year	1.104*** (8.893)	0.021 (0.187)	-0.062* (-1.697)	1.145*** (11.374)	0.193** (2.153)	-0.063* (-1.951)

Table 4.24 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2019.year	1.320*** (10.945)	0.022 (0.175)	-0.058 (-1.435)	1.359*** (13.837)	0.210** (2.127)	-0.058* (-1.654)
2020.year	-0.117** (-2.141)	-0.118*** (-4.903)	-0.018** (-2.086)	-0.106** (-2.301)	-0.140*** (-6.933)	-0.016** (-2.200)
2021.year	-0.096* (-1.797)	-0.006 (-0.308)	-0.014 (-1.602)	-0.087* (-1.936)	-0.024 (-1.406)	-0.012 (-1.525)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Shanxi and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

Table 4.25: Robustness Test Regression Results of Western Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	0.930 (1.302)	-0.055 (-0.403)	0.212 (1.122)	0.721 (1.133)	-0.071 (-0.577)	-0.041 (-0.258)
Teffort	0.393** (2.313)			0.377*** (2.631)		
Gstructure	-3.247** (-2.030)			-2.993** (-2.087)		
Open	0.506 (1.634)			0.897*** (3.510)		
Ind	1.127 (1.234)			-0.027 (-0.034)		
Gscale	-0.509 (-0.936)			-0.075 (-0.162)		
Compete		0.014*** (6.633)	-0.005*** (-2.856)		0.013*** (7.101)	-0.007*** (-4.591)
Transfer		-0.273*** (-4.335)	0.147*** (2.829)		-0.274*** (-4.862)	0.156*** (3.625)
Urban		2.732*** (9.820)	-0.137 (-0.581)		2.615*** (10.497)	-0.465** (-2.438)
Density		-1.448*** (-15.892)	0.238*** (3.166)		-1.441*** (-17.621)	0.262*** (4.098)

Table 4.25 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Ptax		0.966*** (28.755)			0.968*** (32.098)	
Pgdp		-1.567*** (-32.923)	-0.064* (-1.795)		-1.567*** (-36.607)	-0.067** (-2.220)
Fss			0.101* (1.683)			0.029 (0.581)
Capital			-0.014** (-2.562)			-0.015*** (-3.208)
D	1.701*** (11.421)	0.149** (2.307)	-0.005 (-0.093)	1.778*** (13.399)	0.168*** (2.903)	0.045 (1.065)
Constant	-1.375* (-1.867)	1.847*** (4.993)	-0.099 (-0.372)	-0.945 (-1.457)	1.888*** (5.698)	0.142 (0.645)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9735	0.9392	0.6343	0.9732	0.9391	0.6208
Adjust R ²	0.9723	0.9361	0.6131	0.9720	0.9360	0.5988
Inner Mongolia	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Guangxi	-0.973*** (-8.767)	3.563*** (16.472)	-0.599*** (-3.349)	-0.981*** (-9.952)	3.537*** (18.215)	-0.676*** (-4.428)
Chongqing	0.109 (1.337)	4.235*** (16.136)	-0.707*** (-3.245)	0.105 (1.479)	4.214*** (17.886)	-0.777*** (-4.181)
Sichuan	-0.392*** (-4.490)	3.326*** (16.574)	-0.557*** (-3.340)	-0.393*** (-5.069)	3.299*** (18.311)	-0.636*** (-4.465)
Guizhou	-0.677*** (-7.070)	3.164*** (14.294)	-0.617*** (-3.367)	-0.649*** (-7.540)	3.133*** (15.768)	-0.711*** (-4.545)
Yunnan	-0.590*** (-6.253)	2.701*** (15.565)	-0.471*** (-3.269)	-0.561*** (-6.647)	2.670*** (17.144)	-0.560*** (-4.550)
Shanxi	-0.207** (-2.550)	3.327*** (16.257)	-0.548*** (-3.231)	-0.234*** (-3.246)	3.305*** (17.988)	-0.615*** (-4.249)
Gansu	-0.437*** (-3.093)	1.788*** (16.088)	-0.281*** (-3.046)	-0.435*** (-3.420)	1.768*** (17.715)	-0.352*** (-4.445)
Qianghai	0.637*** (3.165)	-1.399*** (-16.000)	0.258*** (3.476)	0.593*** (3.321)	-1.398*** (-17.812)	0.234*** (3.757)
Ningxia	-0.394*** (-4.033)	2.093*** (14.122)	-0.435*** (-3.530)	-0.399*** (-4.519)	2.080*** (15.638)	-0.482*** (-4.575)
Xinjiang	-0.230* (-1.883)	-0.401*** (-9.758)	0.049 (1.497)	-0.305*** (-2.809)	-0.411*** (-11.141)	0.021 (0.760)

Table 4.25 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.008 (0.114)	-0.036** (-2.529)	-0.023* (-1.941)	0.008 (0.115)	-0.035*** (-2.744)	-0.022** (-2.185)
2010.year	0.153 (1.515)	-0.041** (-2.398)	-0.036** (-2.455)	0.170* (1.878)	-0.039** (-2.558)	-0.037*** (-2.961)
2011.year	0.292*** (3.440)	-0.100*** (-4.168)	-0.023 (-1.203)	0.282*** (3.707)	-0.097*** (-4.495)	-0.018 (-1.143)
2012.year	0.389*** (4.153)	-0.159*** (-5.115)	-0.031 (-1.357)	0.366*** (4.379)	-0.155*** (-5.567)	-0.023 (-1.193)
2013.year	0.554*** (5.402)	-0.157*** (-4.506)	-0.042 (-1.645)	0.525*** (5.766)	-0.153*** (-4.900)	-0.034 (-1.594)
2014.year	0.707*** (6.168)	-0.163*** (-4.212)	-0.044 (-1.572)	0.694*** (6.797)	-0.157*** (-4.548)	-0.031 (-1.333)
2015.year	0.830*** (6.331)	-0.163*** (-3.929)	-0.046 (-1.524)	0.822*** (7.041)	-0.156*** (-4.200)	-0.029 (-1.139)
2016.year	1.018*** (6.790)	-0.133*** (-3.061)	-0.039 (-1.212)	1.038*** (7.782)	-0.124*** (-3.186)	-0.017 (-0.639)
2017.year	1.243*** (8.548)	-0.054 (-1.161)	-0.020 (-0.565)	1.291*** (9.984)	-0.042 (-1.022)	0.007 (0.247)
2018.year	1.362*** (9.374)	-0.023 (-0.455)	-0.009 (-0.232)	1.429*** (11.068)	-0.010 (-0.215)	0.026 (0.780)
2019.year	1.604*** (10.467)	-0.034 (-0.600)	-0.005 (-0.117)	1.686*** (12.383)	-0.019 (-0.371)	0.034 (0.946)
2020.year	0.098 (1.452)	-0.092*** (-7.316)	-0.013 (-1.286)	0.111* (1.828)	-0.094*** (-8.304)	-0.021** (-2.331)
2021.year	-0.094 (-1.446)	-0.008 (-0.677)	-0.008 (-0.781)	-0.083 (-1.412)	-0.009 (-0.789)	-0.015 (-1.571)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Inner Mongolia and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

- Analysis of Path of Action Tests and Transmission Effects

To separate the direct effect of VFI on Gstructure from its indirect transmission effect, this study standardizes the variables and re-estimates them using the 3SLS method. The regression results for each region are presented in Tables 4.26 to 4.28. The standardized regression results indicate that the significance of each variable remains consistent with the findings from the baseline regression. Specifically, VFI significantly inhibits the enhancement of Teffort in all three regions, while it also significantly optimizes Gstructure. In turn, Gstructure significantly contributes to the improvement of Quality. Notably, a divergence is observed: in the eastern and central regions, both VFI and Teffort significantly impede the advancement of Quality, whereas in the western region, VFI notably enhances Quality.

Table 4.26: Results of Standardized Regressions in Eastern Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-0.634*** (-3.161)	-0.113*** (-4.623)	0.128*** (4.690)	-0.721*** (-4.006)	-0.114*** (-5.189)	0.132*** (5.455)
Teffort	-0.167*** (-3.311)			-0.168*** (-3.739)		
Gstructure	0.154** (2.085)			0.298*** (4.551)		
Open	-0.670*** (-7.354)			-0.668*** (-8.194)		
Ind	-0.341** (-2.078)			-0.353** (-2.423)		
scale	0.799** (2.386)			0.922*** (3.087)		
Compete		0.009 (0.693)	0.011 (1.586)		0.009 (0.739)	0.011* (1.671)

Table 4.26 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Transfer		-0.005 (-0.671)	0.011*** (2.853)		-0.004 (-0.586)	0.015*** (4.378)
Urban		0.109*** (4.500)	0.026* (1.682)		0.108*** (4.906)	0.020 (1.483)
Density		-0.390** (-2.406)	-0.232*** (-2.832)		-0.397*** (-2.720)	-0.273*** (-3.781)
Ptax		0.560*** (14.390)			0.557*** (15.978)	
Pgdp		-0.713*** (-14.754)	-0.028 (-1.459)		-0.710*** (-16.346)	-0.027 (-1.556)
Fss			0.152*** (3.737)			0.159*** (4.419)
Capital			0.001 (0.122)			0.001 (0.207)
D	2.257*** (6.564)	0.402*** (4.902)	0.059 (1.332)	2.239*** (7.287)	0.402*** (5.436)	0.059 (1.482)
Constant	4.675*** (6.375)	0.935*** (4.456)	0.968*** (8.942)	4.521*** (6.901)	0.947*** (5.015)	1.034*** (10.843)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9602	0.8042	0.8711	0.9589	0.8041	0.8693
Adjust R ²	0.9584	0.7942	0.8636	0.9571	0.7941	0.8617
Beijing	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Tianjin	-3.822*** (-8.416)	0.058* (1.857)	-0.149*** (-6.257)	-3.639*** (-8.998)	0.056** (1.999)	-0.158*** (-7.504)
Hebei	-6.099*** (-7.761)	0.181 (1.062)	-0.321*** (-3.263)	-6.023*** (-8.594)	0.170 (1.109)	-0.377*** (-4.337)
Liaoning	-5.512*** (-7.652)	-0.128 (-0.675)	-0.349*** (-3.291)	-5.522*** (-8.603)	-0.139 (-0.813)	-0.408*** (-4.370)
Shanghai	-1.522*** (-5.150)	0.281** (2.008)	0.112 (1.578)	-1.287*** (-4.881)	0.288** (2.280)	0.148** (2.378)
Jiangsu	-4.584*** (-7.376)	0.381*** (5.547)	-0.140*** (-3.376)	-4.484*** (-8.109)	0.374*** (6.053)	-0.165*** (-4.535)
Zhejiang	-4.602*** (-7.800)	0.144 (1.363)	-0.175*** (-2.911)	-4.605*** (-8.770)	0.137 (1.437)	-0.210*** (-3.958)
Fujian	-5.286*** (-7.407)	0.264 (1.497)	-0.352*** (-3.609)	-5.131*** (-8.076)	0.251 (1.584)	-0.412*** (-4.792)

Table 4.26 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Shandong	-5.453*** (-7.887)	0.401*** (3.841)	-0.214*** (-3.348)	-5.391*** (-8.756)	0.392*** (4.168)	-0.255*** (-4.510)
Guangdong	-3.878*** (-6.679)	0.006 (0.062)	-0.162*** (-3.084)	-3.938*** (-7.622)	-0.000 (-0.003)	-0.193*** (-4.165)
Hainan	-6.040*** (-7.744)	-0.400* (-1.859)	-0.367*** (-3.359)	-6.001*** (-8.619)	-0.411** (-2.124)	-0.433*** (-4.492)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.012 (0.075)	0.027 (1.334)	-0.001 (-0.108)	0.047 (0.336)	0.028 (1.503)	-0.000 (-0.006)
2010.year	-0.017 (-0.086)	0.079*** (3.133)	-0.025* (-1.802)	0.116 (0.633)	0.079*** (3.503)	-0.024* (-1.891)
2011.year	0.278 (1.408)	0.052* (1.672)	-0.031* (-1.818)	0.414** (2.328)	0.053* (1.892)	-0.029* (-1.894)
2012.year	0.271 (1.270)	0.015 (0.385)	-0.027 (-1.255)	0.396** (2.066)	0.016 (0.463)	-0.025 (-1.298)
2013.year	0.177 (0.752)	0.014 (0.324)	-0.002 (-0.081)	0.249 (1.175)	0.015 (0.387)	0.000 (0.005)
2014.year	0.338 (1.303)	0.031 (0.639)	-0.012 (-0.475)	0.451* (1.943)	0.032 (0.735)	-0.010 (-0.449)
2015.year	0.401 (1.478)	0.044 (0.870)	-0.009 (-0.338)	0.517** (2.129)	0.045 (0.987)	-0.007 (-0.300)
2016.year	0.612* (1.821)	0.116** (2.046)	-0.022 (-0.738)	0.787*** (2.619)	0.117** (2.295)	-0.020 (-0.732)
2017.year	0.838** (2.365)	0.186*** (3.094)	0.007 (0.223)	0.939*** (2.961)	0.187*** (3.455)	0.010 (0.357)
2018.year	1.157*** (3.261)	0.236*** (3.588)	0.018 (0.510)	1.231*** (3.881)	0.237*** (4.004)	0.021 (0.684)
2019.year	1.678*** (4.598)	0.258*** (3.634)	0.027 (0.710)	1.743*** (5.344)	0.259*** (4.053)	0.030 (0.898)
2020.year	-0.154 (-0.915)	-0.066*** (-3.349)	-0.040*** (-3.943)	-0.068 (-0.450)	-0.066*** (-3.705)	-0.040*** (-4.426)
2021.year	-0.296* (-1.788)	-0.010 (-0.496)	-0.010 (-0.977)	-0.276* (-1.840)	-0.010 (-0.560)	-0.011 (-1.146)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively.

Table 4.27: Results of Standardized Regressions in Central Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	-0.218** (-2.383)	-0.033 (-0.690)	0.046 (1.143)	-0.298*** (-3.829)	-0.089** (-2.234)	0.048 (1.416)
Teffort	-0.045*** (-3.556)			-0.068*** (-6.463)		
Gstructure	0.071*** (2.850)			0.083*** (4.144)		
Open	0.056 (0.417)			0.136 (1.262)		
Ind	0.137*** (3.228)			0.139*** (4.005)		
Gscale	0.139* (1.661)			0.212*** (3.072)		
Compete		-0.002 (-0.211)	-0.012** (-2.437)		-0.019** (-2.024)	-0.009** (-2.099)
Transfer		-0.063 (-1.518)	0.015 (0.830)		-0.027 (-0.831)	0.012 (0.795)
Urban		0.223*** (3.879)	0.028 (1.107)		0.179*** (3.895)	0.029 (1.318)
Density		-2.106*** (-7.873)	-0.264** (-2.025)		-1.876*** (-8.584)	-0.300*** (-2.691)
Ptax		0.797*** (14.333)			0.764*** (16.559)	
Pgdp		-0.911*** (-15.624)	0.057*** (3.012)		-0.954*** (-19.441)	0.076*** (4.643)
Fss			0.032 (1.088)			0.034 (1.393)
Capital			0.015** (2.251)			0.022*** (3.817)
D	1.838*** (26.069)	0.253* (1.712)	-0.224*** (-3.670)	1.816*** (30.511)	0.429*** (3.559)	-0.256*** (-4.873)
Constant	-1.185*** (-10.604)	0.787*** (9.230)	0.771*** (21.560)	-1.096*** (-11.940)	0.660*** (9.451)	0.792*** (25.735)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9911	0.8786	0.8381	0.9906	0.8721	0.8348
Adjust R ²	0.9905	0.8699	0.8249	0.9900	0.8629	0.8213
Shanxi	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Table 4.27 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Jilin	0.251*** (3.832)	-0.641*** (-5.613)	-0.163*** (-3.065)	0.259*** (4.619)	-0.518*** (-5.567)	-0.191*** (-4.182)
Heilongjiang	0.345*** (3.477)	-1.494*** (-6.172)	-0.260** (-2.288)	0.359*** (4.342)	-1.265*** (-6.427)	-0.288*** (-2.965)
Anhui	0.017 (0.253)	1.473*** (9.506)	0.130* (1.838)	0.071 (1.221)	1.362*** (10.740)	0.143** (2.359)
Jiangxi	-0.099 (-1.536)	0.599*** (11.209)	0.034 (1.448)	-0.067 (-1.231)	0.572*** (12.956)	0.036* (1.797)
Henan	-0.121 (-1.163)	2.370*** (9.954)	0.228** (2.149)	-0.030 (-0.349)	2.171*** (11.154)	0.254*** (2.795)
Hubei	0.277*** (3.179)	1.112*** (14.441)	0.050 (1.545)	0.349*** (4.807)	1.076*** (16.766)	0.056** (2.030)
Hunan	0.059 (0.633)	1.251*** (13.239)	0.077** (1.969)	0.147* (1.873)	1.193*** (15.293)	0.087*** (2.602)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
2009.year	0.108** (2.515)	-0.031 (-1.333)	-0.032*** (-3.284)	0.105*** (2.836)	0.000 (0.001)	-0.033*** (-3.897)
2010.year	0.273*** (5.195)	-0.045 (-1.510)	-0.066*** (-5.172)	0.265*** (5.927)	-0.001 (-0.042)	-0.067*** (-6.152)
2011.year	0.334*** (5.263)	-0.102** (-2.426)	-0.100*** (-6.057)	0.310*** (5.855)	-0.035 (-0.994)	-0.105*** (-7.356)
2012.year	0.353*** (4.958)	-0.169*** (-2.888)	-0.116*** (-5.181)	0.308*** (5.201)	-0.085* (-1.753)	-0.123*** (-6.391)
2013.year	0.436*** (5.797)	-0.196*** (-2.934)	-0.113*** (-4.471)	0.373*** (5.924)	-0.114** (-2.062)	-0.122*** (-5.569)
2014.year	0.596*** (7.193)	-0.194** (-2.477)	-0.146*** (-4.854)	0.533*** (7.705)	-0.106* (-1.655)	-0.157*** (-6.066)
2015.year	0.725*** (8.249)	-0.184** (-2.168)	-0.165*** (-4.966)	0.659*** (8.985)	-0.090 (-1.286)	-0.180*** (-6.265)
2016.year	0.910*** (9.706)	-0.141 (-1.538)	-0.179*** (-4.978)	0.842*** (10.780)	-0.030 (-0.403)	-0.197*** (-6.347)
2017.year	1.118*** (12.417)	-0.038 (-0.374)	-0.185*** (-4.555)	1.056*** (14.030)	0.080 (0.967)	-0.205*** (-5.877)
2018.year	1.276*** (15.319)	0.021 (0.187)	-0.196*** (-4.331)	1.228*** (17.594)	0.157* (1.714)	-0.219*** (-5.627)
2019.year	1.491*** (17.334)	0.022 (0.175)	-0.208*** (-4.190)	1.443*** (20.038)	0.170* (1.691)	-0.234*** (-5.464)

Table 4.27 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2020.year	-0.043 (-0.917)	-0.118*** (-4.903)	-0.012 (-1.137)	-0.050 (-1.244)	-0.134*** (-6.588)	-0.007 (-0.784)
2021.year	-0.059 (-1.319)	-0.006 (-0.308)	-0.004 (-0.327)	-0.066* (-1.680)	-0.022 (-1.282)	0.000 (0.042)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Shanxi and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

Table 4.28: Results of Standardized Regressions in Western Region

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
VFI	0.216* (1.842)	-0.010 (-0.402)	0.108*** (2.597)	0.191* (1.803)	-0.015 (-0.653)	0.102*** (2.758)
Teffort	0.040*** (3.262)			0.036*** (3.248)		
Gstructure	0.049** (2.241)			0.036* (1.869)		
Open	0.259*** (3.218)			0.290*** (4.014)		
Ind	-0.079 (-1.592)			-0.070 (-1.587)		
Gscale	0.061 (1.289)			0.057 (1.330)		
Compete		0.039*** (6.633)	-0.018*** (-3.012)		0.036*** (6.894)	-0.020*** (-3.574)
Transfer		-0.046*** (-4.336)	0.054*** (5.303)		-0.045*** (-4.690)	0.054*** (6.000)
Urban		0.367*** (9.820)	0.002 (0.045)		0.346*** (10.361)	-0.005 (-0.143)
Density		-1.859*** (-15.893)	0.188* (1.691)		-1.827*** (-17.446)	0.200** (2.015)
Ptax		0.787*** (28.756)			0.786*** (32.059)	

Table 4.28 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
Pgdp		-0.903*** (-32.924)	0.004 (0.151)		-0.905*** (-36.726)	0.002 (0.082)
Fss			0.088*** (3.243)			0.085*** (3.506)
Capital			-0.017** (-2.218)			-0.017*** (-2.584)
D	2.014*** (29.248)	0.149** (2.307)	-0.131** (-2.212)	1.998*** (32.208)	0.181*** (3.123)	-0.121** (-2.289)
Constant	-1.017*** (-11.745)	-2.456*** (-11.058)	0.979*** (4.581)	-0.990*** (-12.727)	-2.407*** (-12.109)	1.001*** (5.225)
Region	Y	Y	Y	Y	Y	Y
Time	Y	Y	Y	Y	Y	Y
R ²	0.9800	0.9392	0.7964	0.9799	0.9390	0.7963
Adjust R ²	0.9791	0.9361	0.7846	0.9790	0.9359	0.7845
Inner Mongolia	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Guangxi	-1.111*** (-10.844)	3.563*** (16.473)	-0.262 (-1.274)	-1.082*** (-11.698)	3.490*** (18.021)	-0.289 (-1.572)
Chongqing	0.144** (2.041)	4.235*** (16.136)	-0.411 (-1.643)	0.127** (1.997)	4.161*** (17.708)	-0.441** (-1.965)
Sichuan	-0.485*** (-6.404)	3.326*** (16.575)	-0.285 (-1.491)	-0.467*** (-6.832)	3.255*** (18.117)	-0.313* (-1.821)
Guizhou	-0.810*** (-8.320)	3.164*** (14.294)	-0.247 (-1.174)	-0.769*** (-8.757)	3.084*** (15.569)	-0.278 (-1.473)
Yunnan	-0.706*** (-8.132)	2.701*** (15.565)	-0.189 (-1.142)	-0.677*** (-8.641)	2.631*** (16.939)	-0.215 (-1.451)
Shanxi	-0.381*** (-5.376)	3.327*** (16.257)	-0.263 (-1.348)	-0.355*** (-5.558)	3.263*** (17.805)	-0.288* (-1.647)
Gansu	-0.671*** (-5.225)	1.788*** (16.088)	-0.037 (-0.348)	-0.627*** (-5.403)	1.741*** (17.499)	-0.055 (-0.584)
Qianghai	0.248 (1.491)	-1.399*** (-16.001)	0.258*** (3.032)	0.294* (1.958)	-1.385*** (-17.673)	0.261*** (3.419)
Ningxia	-0.380*** (-4.567)	2.093*** (14.123)	-0.242* (-1.714)	-0.366*** (-4.866)	2.050*** (15.455)	-0.260** (-2.054)
Xinjiang	-0.513*** (-5.323)	-0.402*** (-9.758)	0.094** (2.470)	-0.488*** (-5.613)	-0.410*** (-11.117)	0.090*** (2.655)
2008.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Table 4.28 continued

Dependent Variables	Two-SLS			Three-SLS		
	Quality	Teffort	Gstructure	Quality	Teffort	Gstructure
2009.year	0.111** (2.061)	-0.036** (-2.529)	-0.031** (-2.301)	0.104** (2.139)	-0.033*** (-2.587)	-0.030** (-2.536)
2010.year	0.344*** (5.678)	-0.041** (-2.398)	-0.050*** (-2.921)	0.336*** (6.131)	-0.036** (-2.371)	-0.049*** (-3.229)
2011.year	0.415*** (6.884)	-0.100*** (-4.168)	-0.057*** (-2.619)	0.408*** (7.482)	-0.092*** (-4.271)	-0.055*** (-2.843)
2012.year	0.521*** (7.795)	-0.159*** (-5.115)	-0.082*** (-3.132)	0.509*** (8.448)	-0.149*** (-5.348)	-0.080*** (-3.403)
2013.year	0.683*** (9.432)	-0.157*** (-4.507)	-0.094*** (-3.181)	0.672*** (10.293)	-0.146*** (-4.699)	-0.092*** (-3.471)
2014.year	0.899*** (12.036)	-0.163*** (-4.212)	-0.121*** (-3.778)	0.880*** (13.076)	-0.150*** (-4.347)	-0.118*** (-4.114)
2015.year	1.072*** (13.634)	-0.163*** (-3.929)	-0.128*** (-3.690)	1.049*** (14.800)	-0.148*** (-3.992)	-0.124*** (-3.994)
2016.year	1.300*** (15.709)	-0.133*** (-3.061)	-0.115*** (-3.075)	1.279*** (17.160)	-0.115*** (-2.968)	-0.110*** (-3.287)
2017.year	1.516*** (18.963)	-0.054 (-1.161)	-0.102** (-2.477)	1.500*** (20.818)	-0.033 (-0.800)	-0.096*** (-2.606)
2018.year	1.643*** (21.338)	-0.023 (-0.455)	-0.101** (-2.212)	1.628*** (23.468)	0.000 (0.010)	-0.094** (-2.297)
2019.year	1.919*** (24.410)	-0.034 (-0.600)	-0.112** (-2.253)	1.901*** (26.856)	-0.007 (-0.146)	-0.105** (-2.340)
2020.year	0.158*** (2.776)	-0.092*** (-7.316)	-0.014 (-1.202)	0.152*** (2.947)	-0.095*** (-8.412)	-0.016 (-1.463)
2021.year	-0.066 (-1.178)	-0.008 (-0.677)	-0.004 (-0.341)	-0.067 (-1.324)	-0.010 (-0.900)	-0.005 (-0.474)
2022.year	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)

Note: ① Numbers in parentheses are t-values. ② ***, ** and * indicate the rejection of the original hypothesis at 1%, 5% and 10% significance levels, respectively. ③ The data in this table were calculated by Stata 17.0. ④ Y is an abbreviation for YES, which means that the variable was controlled for in the regression model. ⑤ Inner Mongolia and 2008.year serve as the baseline comparisons for individuals and time, respectively, while 2022.year is omitted due to collinearity.

Based on the standardized regression results in Tables 4.26 to 4.28, this study computes the direct, indirect, and total effects of VFI, Teffort and Gstructure on Quality. The detailed outcomes are provided in Tables 4.29 to 4.31.

According to the results in Table 4.29, the direct effects of Teffort and Gstructure on Quality in the eastern region are -3.501 and 35.067, respectively. In terms of the direct pathway, the direct negative effect of VFI on Quality is 9.413. VFI has two indirect transmission mechanisms affecting Quality. The first is the indirect positive effect of 2.059 through inhibiting Teffort. The second is the indirect positive effect of 19.427 through optimizing Gstructure. Combining the direct and indirect effects, the total effect of VFI on Quality in the eastern region is 12.073.

According to the results in Table 4.30, the direct effects of Teffort and Gstructure on Quality in the central region are -0.667 and 3.216, respectively. In terms of the direct pathway, the direct negative effect of VFI on Quality is 1.349. The indirect transmission mechanism of VFI on Quality is an indirect positive effect of 0.284 through inhibiting Teffort. For the central region, the effect of VFI on Gstructure (0.189) is not significant, so there is no indirect effect of VFI on Quality through optimizing Gstructure. Combining the direct and indirect effects, the total effect of VFI on Quality in the central region is -1.065.

According to the results in Table 4.31, the direct effects of VFI and Teffort on Quality in the western region are 0.954 and 0.433, respectively. At the same time, because the effect of VFI on Teffort (-0.083) and the effect of Gstructure on Quality (0.053) are not significant,

there is no indirect pathway of VFI affecting Quality in the western region. Therefore, VFI in the western region has only a direct effect on Quality, which is 0.954.

Table 4.29: Paths and Transmission Mechanisms in Eastern Region

Mechanisms	Paths and Transmission	Effect	Result	Total Effect
Direct Effect	VFI → Quality	α_1	-9.413	12.073
Direct Effect	Teffort → Quality	α_2	-3.501	
Direct Effect	Gstructure → Quality	α_3	35.067	
Indirect Effect	VFI → Teffort	β_1	-0.588	
	VFI → Teffort → Quality	$\beta_1 \times \alpha_2$	2.059	
Indirect Effect	VFI → Gstructure	γ_1	0.554	
	VFI → Gstructure → Quality	$\gamma_1 \times \alpha_3$	19.427	

Note: ① The indirect effects are calculated by multiplying the coefficients of the direct effects. ② The total effect is calculated by adding the direct effect to the indirect effect.

Table 4.30: Paths and Transmission Mechanisms in Central Region

Mechanisms	Paths and Transmission	Effect	Result	Total Effect
Direct Effect	VFI → Quality	α_1	-1.349	-1.065
Direct Effect	Teffort → Quality	α_2	-0.667	
Direct Effect	Gstructure → Quality	α_3	3.216	
Indirect Effect	VFI → Teffort	β_1	-0.426	
	VFI → Teffort → Quality	$\beta_1 \times \alpha_2$	0.284	
Indirect Effect	VFI → Gstructure	γ_1	(0.189)	
	VFI → Gstructure → Quality	$\gamma_1 \times \alpha_3$	—	

Note: ① Numbers in parentheses are not significant. ②— indicates that the results do not exist.

Table 4.31: Paths and Transmission Mechanisms in Western Region

Mechanisms	Paths and Transmission	Effect	Result	Total Effect
Direct Effect	VFI → Quality	α_1	0.954	0.954
Direct Effect	Teffort → Quality	α_2	0.433	
Direct Effect	Gstructure → Quality	α_3	(0.053)	
Indirect Effect	VFI → Teffort	β_1	(-0.083)	
	VFI → Teffort → Quality	$\beta_1 \times \alpha_2$	—	
Indirect Effect	VFI → Gstructure	γ_1	0.441	
	VFI → Gstructure → Quality	$\gamma_1 \times \alpha_3$	—	

Note: ① Numbers in parentheses are not significant. ②— indicates that the results do not exist.

Based on Tables 4.29–4.31, in terms of the direct effect, the eastern region has a higher degree of marketization, making enterprises more sensitive to tax policies. The tax effort of local governments may increase the tax burden on enterprises, thereby discouraging investment and economic activities, which in turn negatively affects Quality.

Second, regarding the indirect effect, governments in the eastern region are more inclined to mitigate the negative impact of tax effort by optimizing the structure of fiscal expenditures, for example, by increasing investments in infrastructure, technological innovation, and public services. This reallocation and efficient utilization of fiscal resources can, to some extent, promote economic development quality, thereby resulting in a positive indirect effect.

Furthermore, local governments in different regions have adopted distinct strategies to cope with fiscal pressures. In the eastern region, where fiscal revenues are relatively abundant, governments tend to optimize resource allocation by adjusting expenditure structures. In contrast, local governments in the central and western regions face greater fiscal pressures and are more reliant on central fiscal transfers, which limits their capacity to adjust tax effort and expenditure structures.

4.5 Summary of the Chapter

This chapter begins with an overall description and regional analysis of the dependent variable Quality and the key independent variables VFI, Teffort, and Gstructure. It then discusses the results of model identification and diagnostic tests. After confirming

model identification, the chapter conducts unit root tests, multicollinearity tests, heteroscedasticity tests, autocorrelation tests, and the Breusch-Pagan (BP) test. Due to the presence of heteroscedasticity and autocorrelation, a robust Hausman test is employed, determining that the fixed effects model is superior to the random effects model. The BP test results indicate that the random effects model is better than pooled OLS. Therefore, this study uses the fixed effects model for the simultaneous equation regression. The Durbin-Wu-Hausman test reveals endogeneity in the model. The 3SLS method is applied to estimate the simultaneous equations system, which not only eliminates model endogeneity but also addresses potential correlations among the disturbance terms of the equations, thereby enhancing the validity of the estimates.

To test the hypotheses, baseline regressions, robust tests, and standardized regressions are performed at the national level. Subsequently, these regressions are conducted sequentially for the eastern, central, and western regions to analyze the direct impact of VFI on Quality in China and its indirect impact through Teffort and Gstructure. The summarized hypothesis results are presented in Table 4.32.

Table 4.32: Summarized Results of Hypotheses

Hypotheses	Results
H1 : The current level of vertical fiscal imbalances hinders China's economic development quality.	Supported
H2: There is a direct channel of vertical fiscal imbalance inhibiting local government tax effort.	Supported
H3: Tax effort has an inhibitory effect on the quality of economic development.	Supported
H4: There is an action mechanism of vertical fiscal imbalance indirectly affecting the quality of economic development through local government tax effort.	Supported

Table 4.32 continued

Hypotheses	Results
H5: There is a direct channel of vertical fiscal imbalance inhibiting local government expenditure structure.	Not supported
H6: There is a direct mechanism of local government expenditure structure promotes the quality of economic development.	Supported
H7: There is an action mechanism of vertical fiscal imbalance indirectly affecting the quality of economic development through expenditure structure.	Supported

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter provides the overall conclusion of the study, which examines the impact of VFI on Quality in China through Teffort and Gstructure. The study addresses three distinct objectives. The first is to understand how VFI directly affects Quality in China. The second is to explore how VFI indirectly affects Quality in China through Teffort. The third is to investigate how VFI indirectly affects Quality in China through Gstructure.

This chapter begins with an overview of the research findings, followed by a discussion of the results for each hypothesis and their policy implications. Additionally, it addresses the limitations of the study and highlights recommendations for future research. Finally, the chapter concludes with a summary of the overall results.

5.2 Overview of the Study and Findings

The preceding analysis and empirical results indicate that the current degree of VFI in China not only suppresses Quality but also indirectly affects it through the following two channels: first, by inhibiting Teffort, VFI indirectly promotes Quality; second, by improving the proportion of public expenditure on livelihood, VFI again indirectly promotes Quality. Considering both direct and indirect effects, the current level of VFI in China is conducive to improving Quality.

The results for the eastern region are similar to those at the national level. However, in the central region, the total effect is negative because the pathway through which VFI affects Quality via expenditure structure does not exist, and the positive indirect effect is smaller than the negative direct effect. This indicates that VFI in the central region suppresses Quality. In the western region, on the other hand, there is no indirect effect, and VFI directly enhances Quality. Out of the seven hypotheses proposed in Chapter 2, six are proven. The following section will discuss the results of each hypothesis and their consistency with previous research.

5.2.1 H1: The Current Level of VFI Hinders China's Quality

There is sufficient evidence to conclude that VFI inhibits Quality. Both the national simultaneous equations model and the regression results for the eastern and central regions show that VFI has a significant negative effect on Quality at $p=0.01$, whereas the results for the western region show the opposite. This indicates that the current degree of VFI in China has already affected Quality. This result is consistent with previous research (Bao et al., 2017; Sun et al., 2019; Wang et al., 2020; Song et al., 2021; Wei et al., 2021).

5.2.2 H2: Local governments' Teffort Inhibits Quality

There is sufficient evidence to conclude that VFI inhibits Teffort. Both the national simultaneous equations model and the regression results for the eastern and central regions show that VFI has a significant negative effect on Teffort at $p=0.05$. This indicates that the current degree of VFI in China has already affected Teffort. Compared to the eastern and

central regions, the western region, with its higher level of VFI, can relax Teffort through central government transfers. This result is consistent with previous research (Baretti et al., 2002; Jia & Ying, 2016; Chu et al., 2019; Zhao et al., 2021).

5.2.3 H3: VFI Inhibits Teffort of Local Governments

There is sufficient evidence to conclude that Teffort hinders Quality. The results of the simultaneous equations model show that, whether in the baseline regression or the standardized regression, Teffort significantly inhibits Quality. This indicates that the current level of Teffort in China has already affected Quality. This result is consistent with previous research (Shen & Fu, 2006; Becker & Rauscher, 2013; Brülhart & Jametti, 2019; Shangguan & Ge, 2019; Chu et al., 2020).

5.2.4 H4: VFI Indirectly Affects Quality through Teffort

There is sufficient evidence to conclude that VFI indirectly affects Quality through Teffort. The national, eastern, and central regions' standardized regression results from the simultaneous equations model all show that VFI indirectly affects Quality by inhibiting local government Teffort. Due to some insignificant data in the western region, no indirect effect exists. This indicates that the current degree of VFI in China indirectly promotes Quality. This result is consistent with previous research (Klemm & Van, 2012; Lu & Wu, 2019; Miyazawa et al., 2019).

5.2.5 H5: VFI Inhibits Local Governments' Gstructure

There is insufficient evidence to conclude that VFI inhibits local government Gstructure. The results of the simultaneous equations indicate that VFI has a significant positive impact on local government Gstructure at $p=0.01$. This indicates that the current degree of VFI in China promotes the optimization of local government Gstructure. This result is not consistent with previous research (Fu & Zhang, 2007; Gong & Lu, 2009; Amusa & Oyinlola, 2019; Liu et al., 2023).

5.2.6 H6: Local governments' Gstructure Promotes Quality

There is sufficient evidence to conclude that local government Gstructure promotes Quality. The results of the simultaneous equations model show that, whether in the baseline regression or the standardized regression, local government Gstructure significantly improves Quality at $p=0.01$. This indicates that the optimization of local government Gstructure in China can promote Quality. This result is consistent with previous research (Tulsidharan, 2006; Gong & Lu, 2009; Meričková et al., 2017; Amusa & Oyinlola, 2019; Liu et al., 2023).

5.2.7 H7: VFI Indirectly Affects Quality through Gstructure

There is sufficient evidence to conclude that VFI indirectly affects Quality through local government Gstructure. Both the national and eastern regions' standardized regression results from the simultaneous equations model show that VFI indirectly affects Quality by optimizing local government Gstructure. Due to some insignificant data in the central and

western regions, however, no indirect effect exists. This indicates that the current degree of VFI in China indirectly promotes Quality. This result is consistent with previous research (Devarajan, 1996; Fu & Zhang, 2007; Wei et al., 2021).

5.3 Policy Implications

5.3.1 Controlling Vertical Fiscal Imbalance

Based on the calculations in Section 4.2 of this study, it is evident that VFI in China's provinces are on the rise, with significant regional differences. The empirical results in Chapter 4 suggest that the current level of VFI in China has a direct inhibitory effect and an indirect promotional effect on Quality. Overall, the current level of VFI in China is conducive to enhancing Quality. Therefore, a key issue in the upcoming fiscal and tax system reforms will be how to keep VFI within a reasonable range while promoting Quality. According to the definition of and calculation method for VFI in Section 3.4, this imbalance arises from the asymmetry between revenue and expenditure decentralization, with expenditure decentralization averaging twice the level of revenue decentralization outside the eastern region. Thus, policy adjustments can be considered from the perspectives of both revenue and expenditure decentralization.

- **Improving the Division of Authority and Expenditure Responsibilities**

In China, the root cause of excessive expenditure decentralization lies in the unclear division of responsibilities and expenditure obligations among national and regional governments. The central government often seeks to intervene excessively in regional

government affairs without assigning corresponding expenditure responsibilities to the local level. This situation reduces local governments' autonomy while increasing their expenditure burdens, thus dampening their initiative and exacerbating VFI as the revenue-expenditure gap widens. Therefore, clarifying the division of responsibilities and expenditure obligations to improve expenditure decentralization would be an effective way to address VFI.

First, it is necessary to clarify the division of responsibilities among national and regional governments. When a government provides a public good, responsibilities should be assigned according to the number and scope of beneficiaries. If the beneficiaries are many and widespread, such as in high-speed rail, the national power grid, cross-regional pollution control, and nationwide vaccination programs, the higher-level government should be responsible. Conversely, if the beneficiaries are few and localized, such as in local public transportation, municipal water supply, basic education, and community healthcare services, the local government should be responsible. This approach could motivate local governments to provide government goods and services that meet actual needs. However, for public goods with a cross-regional or national impact, the central government should lead, with regional governments coordinating to establish a collaborative mechanism. This dual approach leverages the central government's macro-control while allowing regional governments to apply their local knowledge, thereby reducing costs and improving supply efficiency.

Second, the division of expenditure obligations should be clear, avoiding excessive decentralization of expenditure responsibilities. For public goods solely provided by regional governments, the spending obligations should rest entirely with them, incentivizing efficiency in resource utilization. For cross-county or cross-city government goods and services, expenditure obligations should be reasonably divided based on an expenditure list to ensure fairness. Cross-regional rail transit, watershed management (e.g., water pollution management in the Yangtze and Yellow River basins), and cross-regional medical alliances are facilities and management that require coordinated input from multiple local governments to ensure that policy effects are equitable and efficient. For cross-regional or national public goods and services, it is important to prevent situations where the central government bears significant responsibilities with minimal expenditure obligations, while local governments, despite having fewer responsibilities, bear most of the spending obligations. The central government's expenditure obligations must be balanced, neither assuming too much, leading to local government dependency, nor shirking its responsibilities, aggravating the local fiscal imbalance and increasing the risk of fiscal instability.

Third, a rational expenditure responsibility system is necessary. The central government can introduce detailed guidelines, creating a scoring system for various expenditure items in the fiscal budget, where different scores correspond to different levels of expenditure obligation. This would clarify the specific expenditure responsibilities when providing public goods or services. On one hand, the central government can reasonably

assign expenditure responsibilities according to the actual expenditure items, ensuring fairness. On the other hand, with well-defined expenditure responsibilities, local governments would be more willing to comply, thus regulating their expenditure behaviour and mitigating the common pool effect.

Fourth, local government initiative should be encouraged. Regional development imbalances are a reality in China, with significant differences in economic development quality among regional governments due to disparities in resource endowments and historical development factors. Therefore, using the regional classification method employed in this study (eastern, central, and western regions), the division of spending obligations should consider fiscal disparities among local governments, establishing a system of expenditure obligations that aligns with per capita fiscal revenue and economic development quality. This would encourage proactive management by less-developed regions and help regulate competition among regional governments in providing government services.

- **Rationally Structuring the Fiscal Powers between Central and Regional Governments**

Another key reason for long-term conflict of VFI in local regions is the low degree of revenue decentralization. However, it is essential to ensure that the financial framework for national and regional authorities both stabilizes central government finances and ensures regional governments have financial resources commensurate with their powers and spending responsibilities, allowing each region an optimal degree of revenue autonomy.

First, there is a need for quality local tax sources. Regarding property tax, legislation should be promoted. As a primary local tax and a direct tax, property tax aligns well with the current context of tax system reform in China. Following pilot reforms, property tax has shown significant potential in increasing local tax revenue, despite challenges such as the coexistence of taxes and fees. Property tax legislation will better harness its inherent advantages, gradually making it a mainstay of local tax revenue and stabilizing local tax sources.

Regarding the resource tax, although 90% of the current revenue is allocated to local governments, the distribution among provincial, municipal, and county levels is uneven. Provincial governments retain the majority of the resource tax revenue, despite the fact that most resource extraction takes place at the municipal or county level. To better equip city and county governments with the fiscal capacity to mitigate environmental damage from resource extraction and to promote green development, it would be valuable to allocate a greater share of resource tax revenue to these local levels.

Regarding the environmental protection tax, based on this study's measurement of economic development quality indicators, green indicators have improved significantly in recent years. The environmental protection tax has greatly influenced corporate behaviour, reducing pollutant emissions and generating fiscal revenue. The scope of the environmental protection tax should be expanded, with more detailed collection standards and increased oversight and enforcement on tax-paying enterprises.

Additionally, given China's significant regional differences—eastern and western regions differ by as much as 34.38 points in regional scores—and varying environmental governance priorities and pollution sources (e.g., air pollution, water pollution, industrial pollution), future efforts should focus more on regional cooperation. An improved cross-regional environmental information platform should be established to facilitate regional interaction and the connectivity of environmental information.

Second, it is important to enhance local tax autonomy. The most direct approach would be to moderately increase the proportion of tax revenues allocated to local governments, while maintaining the stability of central finances. However, under the current VFI in China, merely granting regional authorities a share of tax revenues is insufficient; it is a temporary fix that does not fundamentally improve revenue-generating capacity. To establish a more supportive institutional framework at the regional level, it is essential to moderately expand the limited tax legislative authority of local governments.

The Legislation Law formalizes the principle of tax legality, providing institutional support for local tax legislative authority, which should be supplemented with appropriate oversight mechanisms. For taxes requiring central macro-control but adaptable to local conditions, local governments should be granted a degree of tax autonomy, such as the power to grant certain tax exemptions, adjust tax rates, or add and remove tax items. This would contribute to the stability of local tax revenues, enhance regional tax effort, and establish a mechanism for financial revenue growth, thereby improving revenue decentralization.

5.3.2 Tailoring the Policy to Local Conditions

From a regional perspective, different areas should formulate different fiscal policies based on their unique economic characteristics to enhance the positive impact of fiscal policy on Quality and achieve coordinated regional development.

- **Reducing Vertical Fiscal Imbalance and Optimizing Fiscal Expenditure Structure**

In the eastern region, VFI negatively affects Quality directly, while the indirect effect through Gstructure is positive. However, the overall impact remains negative. Therefore, policies should focus on reducing VFI and optimizing Gstructure to mitigate its adverse effects on Quality.

First, enhancing local fiscal autonomy is essential. The proportion of tax revenue shared with local governments should be appropriately increased, reducing dependence on central government transfers to strengthen local fiscal independence. Additionally, local tax system reforms should be explored, such as optimizing local taxation and increasing the share of local tax revenue, thereby improving the financial capacity of local governments.

Second, it is necessary to optimize the fiscal expenditure structure and improve expenditure efficiency. There should be more fiscal resources for high-quality development areas such as innovation, green development, and public welfare to enhance the efficiency of fund utilization. Moreover, fiscal budget performance management should be further strengthened to ensure that public funds effectively contribute to Quality.

Finally, fiscal institutional reforms should eliminate inefficient expenditures and fiscal transparency reforms should prevent unnecessary administrative expenditures and enhance the efficiency of public fund utilization. Additionally, digital fiscal technologies should help improve local fiscal management and maximize the effectiveness of fiscal resources.

- Enhancing Local Tax Effort and Improving Fiscal Expenditure Efficiency

In the central region, the direct impact of VFI on Quality is negative. Its indirect effect through Teffort is positive, but its impact on Gstructure is not significant. Therefore, policies should focus on improving local governments' Teffort while enhancing fiscal expenditure efficiency.

First, strengthening local tax collection capacity to enhance fiscal autonomy is crucial. Local governments should improve tax enforcement, reduce tax evasion, and increase the sustainability of local fiscal revenues. Additionally, tax policies should be optimized to reduce reliance on short-term fiscal stimuli, such as land-based finance, and promote long-term stable tax revenue growth.

Second, it is key to optimize fiscal expenditure and enhance fund utilization efficiency. There should be fiscal investment in technological innovation, infrastructure, and public services to improve Quality and sustainability. Furthermore, fiscal performance evaluations should be reinforced to enhance expenditure efficiency and minimize inefficient investments and redundant construction projects.

Finally, deepening fiscal system reform to reduce VFI is imperative. Fiscal institutional reforms should gradually adjust the revenue-sharing ratio between central and local governments, thereby increasing local fiscal independence. Strengthening local governments' fiscal accountability and reducing excessive reliance on central government transfers will further improve their fiscal sustainability.

- Expanding Fiscal Investment and Strengthening Local Fiscal Autonomy

In the western region, VFI has a positive direct impact on Quality, with no significant indirect effect. Therefore, policies should focus on expanding fiscal investment, optimizing the expenditure structure, and strengthening local fiscal autonomy to further consolidate the positive role of fiscal policy in economic development.

First, enhancing central fiscal support to promote regional coordinated development is necessary. The central government should continue increasing financial support for the western region, with a particular focus on infrastructure development, environmental protection, and technological innovation, thereby strengthening the region's economic growth momentum. The scale of fiscal transfers should moderately expand, ensuring the precise allocation of funds and improving fiscal resource efficiency.

Second, optimizing the fiscal expenditure structure to promote Quality should be a priority. Local governments should be granted greater decision-making power in fiscal expenditures to ensure public funds go to sectors that enhance Quality, such as education, healthcare, and technology. Furthermore, innovative fiscal investment models, such as

public-private partnerships, should be promoted to encourage private sector participation in infrastructure and public service projects.

Finally, enhancing local fiscal autonomy to drive regional economic growth is essential. Local governments should explore new sources of fiscal revenue, such as developing specialized industries, encouraging private sector growth, and fostering emerging industries to enhance fiscal self-sufficiency. Additionally, fiscal management system reform should improve transparency in local government finances and maximize the efficiency of public fund utilization.

5.3.3 Optimizing Performance Evaluation and Incentive Indicators

The analysis in Section 4.2.2 reveals that the overall level of Quality across China's provinces is relatively low, with significant disparities among provinces, characterized by higher scores in the eastern region and lower scores in the central and western regions. Furthermore, there are varying degrees of deficiencies and shortcomings in innovation, coordination, green development, openness, and shared development across provinces. Additionally, the empirical results in Chapter 4 demonstrate that local governments' tax effort and public expenditure structure indirectly influence China's Quality. As China's fiscal decentralization reforms are accompanied by political system reforms, local officials, driven by the incentive of economic competition for promotion opportunities, tend to prioritize public expenditures that yield short-term economic benefits while neglecting long-term investments in public welfare.

Therefore, to fundamentally shift local governments' focus from short-term economic gains, China should consider incorporating livelihood-related indicators into the performance evaluation system for local government officials. This would increase the proportion of public welfare expenditures in public spending, thereby establishing a regionally tailored performance evaluation system for Quality that effectively incentivizes officials.

- Constructing a Regionalized Indicator System for Economic Development Quality

As analysed in Chapter 3, there are significant disparities in innovation development across provinces in China. While several provinces in the eastern region have relatively low scores in coordination, the western provinces have shown stable improvements in this area. However, scores in green development are generally low across the board, indicating a lag in ecological civilization construction. Additionally, the degree of openness is generally low, with substantial interprovincial differences, and outside the eastern region, shared development is generally poor among provinces. These observations highlight the overall inadequacy of Quality in China.

To address these challenges, the central government should provide targeted policy support or fiscal assistance to help provinces overcome their weaknesses and enhance overall welfare levels. Guided by the new development philosophy of innovation, coordination, green development, openness, and shared development, the government should establish a reference framework for the economic development quality indicator system.

In the eastern region, where economic development is already relatively advanced but coordination scores are lagging, there should be more emphasis on areas like industrial structure, urban-rural integration, and the balance between investment and consumption. In the central region, efforts should focus on enhancing openness to increase the competitiveness of foreign enterprises. In the western region, where the level of shared development is particularly low, greater investment is needed in public infrastructure such as healthcare, culture, and transportation.

In summary, each province should tailor its economic development quality indicator system to address its specific shortcomings, thereby ensuring that adjustments to public expenditure structures and fiscal system reforms are both targeted and effective.

- Improving the Performance Evaluation Mechanism for Officials

One significant factor contributing to the low Quality has been the previous GDP-centric performance evaluation system, which led local governments to pursue economic growth blindly, with a disproportionate focus on economically constructive expenditures in public spending. To address this, it is crucial to continually refine the top-down performance evaluation mechanism for local government officials, guiding orderly and regulated horizontal competition among local governments. Through the learning and demonstration effects of interregional competition, innovations in institutional practices can be disseminated more effectively across regions, enhancing overall governance efficiency and improving Quality.

Empirical results suggest that local government competition, via indirect mechanisms, generally suppresses Quality. Specifically, while competition raises tax effort, it hampers the optimization of expenditure structures, which negatively impacts economic quality. Therefore, the government should actively optimize the performance evaluation system for officials and strengthen mechanisms for interregional exchange and interaction among officials. This will accelerate the dissemination and implementation of institutional innovations across regions, ensuring that the learning and demonstration effects of competition among local governments are fully realized.

First, the performance evaluation system for government officials should elevate the importance of resident welfare within the evaluation framework. When making policy decisions, local officials must consider three factors: fulfilling higher-level tasks, performing their local duties, and assessing their own interests. Hence, the strategies and policies adopted by local governments in horizontal competition are largely influenced by the trade-off between enhancing resident welfare and maximizing personal gains. To this end, the evaluation system should promote a comprehensive evaluation framework led by assessment departments, with self-evaluations by units, participation from third-party institutions, and input from local residents. In setting evaluation criteria, there should be greater emphasis on improving basic public services, while also developing indicators to measure resident happiness, thereby integrating resident satisfaction into the official evaluation system. This will increase officials' preference for policies that prioritize public welfare.

Moreover, the evaluation results should serve to incentivize officials with rewards and promotions for high performance while imposing penalties or requiring rectification for poor performance. This would strengthen the linkage between officials' career advancement and the well-being of local residents, ultimately contributing to the continuous improvement of Quality from the perspective of enhancing residents' living standards.

Second, a stronger mechanism for interregional exchange and interaction among local officials would promote the dissemination and implementation of best practices from economically advanced regions to other areas. By leveraging the learning and demonstration effects, this will drive a comprehensive improvement in Quality nationwide. On the one hand, local officials should firmly establish the principle that true achievement lies in serving the people. They should focus on both tangible projects that deliver immediate benefits to the public and long-term initiatives that lay the groundwork for future generations. An exchange mechanism among officials can facilitate the widespread dissemination of effective governance practices across regions, thereby enhancing the institutional innovation capacity of local authorities. On the other hand, it is important to reward regional authorities and officials who make significant contributions to institutional and theoretical innovations. This would reduce the likelihood of free-riding within the exchange mechanism and prevent regions from falling into a pattern of mere imitation and dependence, thereby minimizing the negative incentives associated with the imitation effect on officials in more innovative regions.

5.4 Limitation of the Study and Future Research

This study provides an initial exploration of the direct effects of VFI on Quality, as well as the indirect effects through its impact on local governments' Teffort and Gstructure. However, there are several limitations due to my limited theoretical expertise.

First, the construction of the indicator system for Quality may be incomplete due to limitations in the author's perspective and data availability. Future research should aim to refine the indicator system to better align with China's economic development, providing more targeted and scientifically feasible policy recommendations.

Second, due to the implementation of new government expenditure classification standards and statistical criteria in China since 2007, coupled with the lack of statistical data for Tibet, the sample period for this study is from 2008 to 2022, covering 30 provinces and excluding Tibet, Hong Kong, Macau, and Taiwan. Therefore, the research results are limited to this period and these 30 provinces. Future research should increase the sample size to all provinces, consider further sensitivity analysis, attempt more analytical methods, and reassess the model settings and assumptions.

Third, 3SLS can only qualitatively analyse the direction and magnitude of the relationship between VFI and Quality. It cannot accurately measure the specific degree of VFI that is beneficial for Quality in China. Further research is needed to determine the optimal range of VFI to ensure the continuous improvement of China's Quality.

5.5 Conclusion

The main conclusions are as follows.

First, by employing the 3SLS method, the study reveals that VFI affects Quality through both direct and indirect pathways. An increase in VFI not only significantly suppresses Quality directly but also indirectly affects it by hindering local governments' Teffort and improving Gstructure devoted to people's livelihoods.

Second, after standardizing the panel data, the study further quantifies the magnitudes of the direct and indirect effects within the impact mechanisms. For the Teffort model, the direct effect is smaller than the indirect effect, whereas for the Gstructure model, it is larger. Overall, the current level of VFI is conducive to enhancing Quality in China.

Third, regional regressions for the eastern, central, and western regions show that the results for the eastern region are consistent with the national findings: the direct effect of VFI on Quality is negative, the indirect effect is positive, and the total effect is negative. However, in the central region, the direct effect of VFI is negative, and due to the insignificant impact on Gstructure, there is no indirect effect through this channel, while the indirect effect through Teffort is positive, resulting in a negative total effect. In the western region, meanwhile, the direct effect of VFI on Quality is positive, and since there is no indirect effect, the total effect is also positive.

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